

November 5, 1962

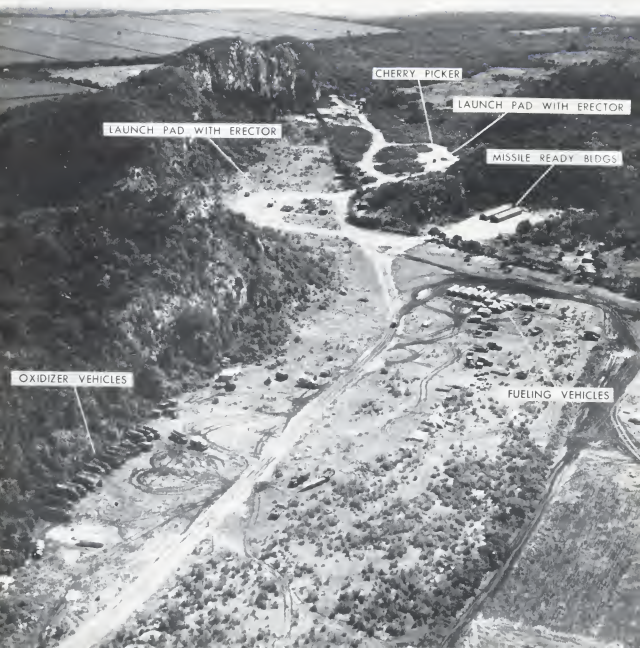
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AEROSPACE CALENDAR

(Continued from page 7)

- Feb. 16-Symposium in Engineering for Space Scientific Program Groups held at Technology Atlanta Ga.
- Feb. 19-19-Third International Symposium on Quantum Electronics, UNESCO Building, Paris, France. Sponsored by International Scientific Radio Union, Office of Naval Research, La Jolla, California, and University of Tennessee.
- Feb. 20-22-1975 International Solid State Physics Conference, Philadelphia. Pa. Sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers, University of Tennessee.
- Mar. 14-Propulsion Meeting, Institute of the Aerospace Sciences, Cleveland, Ohio.
- Mar. 17-18-4th Air Force Symposium, American Rocket Society, Colorado Springs, Colo.
- Mar. 19-20-Apex Flight Engineering Conference, American Rocket Society and Institute of the Aerospace Sciences, Cocoa Beach, Fla.
- Mar. 21-22-Advanced Air Force-sponsored Symposium on Space Defense, Hotel Dayton, Ohio.
- Mar. 25-26-International Conference on Radio Engineers, Student Union and Columbia, New York, N.Y.
- Apr. 1-2-1975 Annual, Scientific and Technical Conference, American Rocket Society and Institute of the Aerospace Sciences, El Segundo Hotel, Palm Springs, Calif.
- Apr. 24-Symposium, Airport Operation Conference, Stanford Hotel, Washington, D.C.
- Apr. 30-1-1975 Symposium on Engineering Aspects of Magnetospheric Space, University of California, Berkeley, Calif.
- Apr. 17-18-1975 National Magistrate Conference, Stanford Hotel, Washington, D.C. Sponsored by American Institute of Electrical Engineers, IRE.
- Apr. 27-28-Scientific Conference, and Electronic Show, Institute of Radio Engineers, Dallas, Missouri, St. Louis, Mo.
- Apr. 29-30-Technical Meeting, Nuclear Materials for Space Applications, American Nuclear Society, Northern Hotel, Chicago, Illinois.
- May 23-24-Third National Symposium on Human Factors in Electronics, Institute of Radio Engineers, Marriott Hotel, Bethesda, Md., Washington, D.C.
- May 29-30-1975 Computer Conference, Institute of Radio Engineers, Marriott Hotel, Bethesda, Md., Washington, D.C.
- May 31-1975 National Aerospace Electronics Conference, Institute of Radio Engineers, Dayton, Ohio.
- May 31-1975-Computer Control Flight, American Society of Naval Engineers, Air Transportation, Bedford, Conn.
- May 30-31-24th Annual Symposium on Vibration Theory and Techniques, Institute of Radio Engineers, Marriott Hotel, San Francisco, Calif.
- May 31-1975 French Scientific Air, Air de Bourget, Paris, France.

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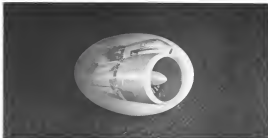
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EDITORIAL

The Sour Trumpet

Last week we asked on this page that the validity of this nation's position in the Cuban crisis was nearly destroyed by official ineptitude in attempting to stop public release of the aerial reconnaissance pictures that proved beyond any shadow of doubt that Soviet ballistic missiles were being emplaced on Cuban sites and aimed at U.S. targets. In the ensuing week, it became apparent that this was not just one small facet of a deliberate, halfhearted effort by a political administration in withdrawal from and denial of news that affect the life and fortunes of every American citizen.

The chief contraband in this newly formed Ministry of Truth in the Kennedy Administration appear to be Arthur Sylvester, former Washington correspondent for the Newark Evening News who is now assistant secretary of defense for public affairs. We have watched a series of inept, amateurish blunders trickle through the job during the past decade, including R. Karl Rosenbaum whose Panama drill supports philosophy quickly ended his Pentagon career, Robert Trapp Ross who tripped over his brother-in-law's pants in a conflict of interest case, and Mervyn Seider who proved to be a blunt tool in executing Presidential Press Secretary James Hager's policies in the Eisenhower Administration. But none of these predecessors ever approached the lengths to which Arthur Sylvester has gone to use the Pentagon public information machinery to withhold and distort news at a vital matter beyond the requirements of legitimate military security. Sylvester, whose performance is being financed by taxpayer dollars, finally shocked every form of communication media into better point of his actions last week.

Two actions in which he blantly admitted his role as a controller of the news to fit political purposes, rather than as a dispenser of facts, were:

- He issued a directive requiring all Defense Dept. employees to report to his office in phone or written message the substance of any conversation they might have with a representative of any public media. Since the plea of administrative red tape this would create makes it clear Sylvester did not expect compliance, it is equally clear that this was simply held information of someone who would challenge Sylvester as the sole source of the Defense Dept.'s distorted news of the Cuban crisis, even if military security was not involved.

- He calmly maintained that his use of censorship and distortion of the news was "justified" because it permitted the "Commander in Chief" to speak with a single voice and use news control beyond military security as "necessary" in the cold war.

These statements by Sylvester evidently reassured many of the mass media executives who have not followed developments in the Pentagon too closely during the past two years. But they were no surprise to Air Force public relations officers who recently heard Sylvester tell them in a closed meeting at the Air Force Ann Convention in Las Vegas that their primary job was to see that credit was reflected on the Kennedy Administration. Nor were they a surprise to regular Pentagon reporters who watched a set of exclusive Cuban missile base

photos appear in a weekly news magazine that also contained a story lauding Sylvester's performance in a Pentagon monthpiece.

Sylvester's sole performance as the Pentagon's boss trumpet during the Cuban crisis has been so bombing that even if his superiors approve his thought control policy, they can't afford his next execution of it much longer. Sylvester's Pentagon briefings have been so poor that superiors forced more accurate, perceptive and complete briefings on the military situation at the State Dept.

In a larger sense, Sylvester's failure has also been the failure of his boss, Defense Secretary Robert S. McNamara, to understand and handle competently a large and vital part of his role not only as custodian of a \$70 billion annual bag of taxpayers' dollars, but also in the principal function of the defense and safety of these taxpayers and their families. The Pentagon can certainly benefit from more efficient accounting methods and inventory control, but it also must have a responsible leadership that discharges its full obligations to the American people to inform them of their dangers and their defenses. Meritt McNamara and Sylvester have failed miserably in their first crucial test in this important role.

But the issues involved in Sylvester's practice of news control to achieve political goals go far beyond the spectacle of a senior trumpet player fumbling with the wrong valves and letting a succession of sour notes. They strike at the fundamental nature of the American system of government and the validity of the image the American people and our allies abroad think we are fighting for. The basic freedom of Americans life in thoughts, opinions and religious is its strongest attraction for those areas of the world where their freedom are curbed or denied. If we are now to allow the power of our own government to be used to suppress the basic elements of that freedom in this country, what a horrible future we have to face! What a dismal prospect we sell present to our allies!

Even more are emphasized these dangers, such as our open shots in the Mexican national space program and in the admission of space facilities, our international stature grows and the present measures against the Soviet system of suppression. If our responsible government officials are now striving to adopt the Soviet methods of political censorship, single-source thought control and manipulation of the news for political purposes, what a shabby image we will present abroad and how poorly has our leadership misinterpreted the solidarity of the reaction of the non-communist nations to our initial Cuban stand.

The White House and Pentagon were quick to scold the press of its responsibilities in their guidance on legitimate military security news in the Cuban crisis. But both agencies were just as quick to forget their responsibilities to see that the American people were fully and honestly informed of developments in that crisis within the bounds of military security.

—Robert Hote



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WHO'S WHERE

In the Front Office

A. M. Latta, vice president-technical and executive, directed a division and assumed the executive committee of Douglas Aircraft Co., Inc., Santa Monica, Calif. Also B. J. Tuller, executive assistant in the personnel department.

R. C. Schell, directed a division of Cals Electronics, Inc., San Diego, Calif. Formerly vice president-corporate affairs of General Dynamics/Convair. Mr. Schell now is a consultant to NASA (JAN 30 p. 25).
W. M. McFarland, head chemist, Lockheed Corp., Little Rock, N. Y., and R. L. Bates, president and chief executive officer, John T. McGraw, executive vice president, Vespene Division of Kord Industries Inc., Pasadena, Calif.

Capt. Robert Shaker, president, Aerospace Sciences Associates, Los Angeles, Calif. Capt. Shaker is also president of Aerospace Consultants, Inc.

Joseph M. Wukh, a corporate vice president, San Diego, Calif. While not in business as president of the Instrument Division, Grand Rapids, Mich.

Wes Frederick Robert L. Olson, head of the newly constituted Systems Division of Aerometrics, a division of North American Aviation, Inc., Anaheim, Calif.

Col. James M. Ardison (USAF), is a member of the advanced planning staff of United Aircraft Corp., East Hartford, Conn., and executive in the vice president and chief scientist, Perm. P. Pratt, Calif. Latham joined from the Air Force as deputy for technology in the Air Force Systems Command's Space Systems Division.

Vice President Richard Dwyer succeeded Dr. David D. Glenn in general manager of the Bendable Co., Inc., Palo Alto, Calif. Dr. Glenn, a founder of the company, is returning to Stanford University for his research duties but will continue as an advisor and a technical consultant.

Thomas F. Henrich, vice president finance and administration, Cook Electronics Co., Chicago, Ill.

Glen A. Walker, vice president product research, Cubic Corp., San Diego, Calif.
J. V. Dillard, vice president of operations, Radio Active, Inc.

Henry J. Schmitt, assistant to the president of Thompson Radio Electronics, Inc., New Canaan, Conn. B. G. Giffels, Deputy Inspector General for Safety of the U. S. Air Force will become Vice Commander at all U. S. Forces in North Africa and Middle East (JAN 16, 1963).

Honors and Elections

1st Lt. John H. Glenn, Jr. has received the first Alfred A. Cunningham Trophy as the "outstanding Marine aviator of the year." The First Marine Aviation Force Veterans Assn. presented the trophy.

Prof. Howard S. Leibel, of Stanford University and United Technology Corp., has been named recipient of the American Rocket Society's 1962 G. Edward Poulley Award, which is given in recognition of outstanding contributions to astronautical literature.

(Continued on page 142)

INDUSTRY OBSERVER

Technical and funding requirements for development of large solid propellant rocket motors above the 120-in. dia. size were discussed last week by National Aeronautics and Space Administration headquarters officials and personnel from the 623A Divisions of USAMF Systems Command's Space Systems Division. Technical areas include feasibility studies in thrust vector control, ignition, nozzle, nose configuration and new facilities—like latter taking the bulk of funding. Industry feeling is that if Defense Dept. and NASA do not agree soon on a coordinated program (JAN 10, p. 16), discussion of future of big solid motors will slide entirely to NASA, which probably would go directly to work on a 180-in. dia. motor.

Lockheed, one of the four aerospace companies that were selected by Army Missile Command to conduct known studies of a solid-propellant sub-orbital vehicle for the Husho defense program (JAN 10, p. 24), has discontinued its efforts and dissolved its study group, apparently because it was unwilling to accept cost-sharing aspects of the proposed contract. The two-stage, high-acceleration vehicle is called Spirit, an acronym for solid-propellant rocket intercept.

Air Force is evaluating an advanced, unmanned re-entry test vehicle called SCOTIE (Super-orbital Coasting Test Integrated Environment) to determine if actual flight program should be undertaken. The 1,500-lb., 11-ft., elliptically cone-shaped SCOTIE vehicle has nearly completed theoretical and wind tunnel analysis of aerodynamic heating and stability and control at super-orbital velocity—which is defined as greater than orbital, but less than space velocity. Work in the program is being conducted by Hypersonic Flight Section of Aeronautical Systems Division's Flight Dynamics Laboratory.

Air Force hopes to cut the time to estimate the Titan 2 as a Gemini launch vehicle (JAN 10, p. 25) by upgrading most of the special Gemini systems, such as abort seating and accommodations, during qualification flight of the Titan 2 weapon system.

North American Aviation's Space and Information Systems Division last week announced competition for the propellant loading and unloading system for the Saturn 2 booster to a group of companies believed to include Aerojet Associates, Pugetson Ultrasonics and Space Technology Laboratories.

Army's competition for study to define surveillance aircraft configurations has been awarded. The request for proposal had been issued from Ft. Belvoir, Sept. 25, and proposals were due Nov. 5.

One Army consideration in placement of its Sergeant ballistic missile batteries is that should the enemy be capable of striking with a 100-mileton weapon, the Sergeant unit must be supported by at least 45,000 lb. to provide line of fire to the battery from attack with a single nuclear weapon.

Sikorsky has delivered the first three of a projected initial order of 28 HS-62 twin-turbine helicopters to the Air Force following that service's decision to purchase the Sikorsky helicopter under the SIC-176 requirement instead of the Vostok 807. The three HS-62s were delivered to OAS AFH, Maui, to be used in support of USAF's Vintor-Torcer radar defense in the Atlantic Ocean (JAN 7, p. 68). Those other HS-62s, designated 54-11, by the Air Force, are already at OAS under contract from the Navy. All six helicopters are standard HS-62 versions minus anti-submarine warfare equipment. Remains of the planned order of 28 helicopters will feature man-overboard (MOB) and will be used for logistic support of anti-submarine ballistic missile sites.

Soviet Union may soon launch its first meteorological satellite, perhaps by early next year, is the opinion of American scientists who attended the recent International Astronautical Congress in Budapest (JAN 10, p. 35). Russian scientists showed interest in discussing U. S. cooperation with Titan satellites and supplied that the Soviet Union's first meteorological satellite launch is near.



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Washington Roundup

Max Performance

AN F-105, unsuccessful in its efforts to persuade Defense Dept. it should have its own man-in-space program rather than rely on that of the National Aeronautics and Space Administration, now is planning to grab a plastic dummy.

The man-sized dummy is called "Max the Phantasm." Max would be placed in orbit through the dense parts of the Van Allen belt to assess the effects of severe radiation on man. The dummy planned for use has plastic frame surrounding human torso. The effects of radiation on man chambers inside the dummy would be transmitted to earth.

Project is being handled by Kenneth APE, N.M. The anthropomorphic dummy would be the last utilized by the U.S. Some U.S. space officials believe Russia shot at least one dummy into space before entering cometary.

First cooperative U.S.-Russian space project possible will consist of signal-beaming experiments with the Echo 2 passive communications satellite. Future of such projects could depend on the Cuban crisis. Despite the U.S.-Soviet cooperation since from an exchange of letters between President Kennedy and Soviet Chairman Khrushchev, space leaders in both countries were not an agreement when the Cuban missiles exploded. Talks to date also have led the groundwork for joint nuclear and geostatic satellite experiments.

Crisis Cost Estimates

Defense Dept. budgeters fear the blockade and other in-lieu operations stemming from the Cuban crisis may push the department through its Fiscal 1963 budget ceiling. Army, Navy and Air Force already are estimating their cost if the crisis is extended. Congress would undoubtedly appropriate any extra money needed, but this would disrupt Defense Secretary Robert S. McNamara's economy savings.

Defense Dept. and NASA are trying to work out an agreement to govern the operation of the newly acquired portion of the Atlantic Missile Range. Air Force is trying to keep control of the range but has been threatened to date by contractors put into the NASA authorization act this year by the House space committee. The space authority is made to hold hearings next year if Defense Dept. and NASA cannot agree on an AMR operations plan. The NASA authorization law gives the space agency jurisdiction over the 75,000-acre missile site at AMR.

Stereoscopic Myopia

Importance of aerial reconnaissance in the Cuban crisis was recognized publicly last week when President Kennedy had Air Force Chief of Staff Curtis LeMay bring two reconnaissance pilots and a photo interpreter with him to the White House.

Meanwhile, the government's own policy on the photographs was fuzzy. While intelligence agencies delayed release of Cuban aerial photos for more than 40 hr after President Kennedy's Oct. 22 speech, U.S. intelligence agencies began a 7-day, around-the-clock effort which produced 77,704 photographs, 10,000 reconnaissance photographs, 10,000 photo plans, 9,000 mosaic plans, 1,570 urban sketches and 1,000 topographic drawings for distribution to 215 of its field posts in 107 countries abroad. USAF worked from 55 aerial photos. Only 32 were released to the U.S. public. USAF generally issued a press release telling how it shot "two of the most incredible evidence of the secret Soviet missile buildup in Cuba" and supplemented other efforts to "get the U.S. spot of view across to as wide an audience as possible." The intelligence agencies had agreed that release of such a few photos would cost too much to Russia about U.S. reconnaissance capability.

Missile B Objective

In a frankly political move aimed at helping elect Democrats in Michigan this week, the Administration last week gave a Ford company two important contracts but angled for the work to be done near Detroit. Long-term-Vought will discuss order for the Corp., after a 60-day program delivery plan, while Chrysler will build the Navy's Missile B in the Ann Arbor-Warren General Plant, where Chrysler built the Red Arrow and Jupiter missiles. R-T-V also won a \$12-million development contract for a man-and-roboter two stage track based on its company-developed "Gemsas-Gem" vehicle. Much of the track work could end up being subcontracted to Chrysler. Acas said it expects that most of the major assemblies for the vehicle will be obtained from the automotive centers of Michigan. Chrysler-Vought Division of R-T-V will occupy about two-thirds of the 2,100,000 sq. ft. plant. It will add 150 technical and management people to Detroit at first, and employment there will reach 1,000 next year. The satellite contract will be for about \$100 million. Acas will produce Missile B's pre-produced liquid fuel.

Dr. Alvin Barthelemy, 32, one of the so-called Pentagon boys who has been a prominent in the region of his former boss, Henry Samuelson, secretary of defense (programming) in the office of Comptroller Charles F. Hays. Barthelemy has been given the title of deputy assistant systems analyst, taking the entire office, which specializes in cost effectiveness studies (AW Oct. 5, p. 27) away from McCullough and assuming equal rank with him. McCullough, who has been left with only the systems planning function, is expected to resign at the end of the year. —Washington Staff



U.S., Britain Begin Airlifting Arms to India

Washington—U.S. and British aid work began shifting military equipment to India after Russia refused to supply the weapons the Indians needed to fight better-armed Chinese Communist forces.

would not ship arms to India. This apparently means Russia will not supply the 12 MIG-23 jet fighters promised to India and it raised hopes in France that the Dassault Mirage 2000 would be bought instead. The first six MIGs were to be delivered this December. Russia's decision cost India, thus, nearly the arms

Soviet Air Force Col. Nikolai A. Voznesenskiy said that "flights in single (Roman) movements will no longer be made" because Vozok 3 and 4 pilots in group flight "usual space flight is far easier than" the Vozok 1 and 2 movements, *the two words*.

ment to help India manufacture VK 7 turbojet engines for the Indian Hindustan 24 jet fighter built at Bangalore (AWM Jan 1, 1962, p. 36).

Like an adequate answer to the question of why India was so poorly prepared to fight the invading Communists India needs all kinds of modern military weapons—automatic rifles, mortars, bazookas, anti-vehicles—as well as aircraft and helicopters which are essential at high altitudes.



earlier version of the C-119, equipped with a 134 hp auxiliary power Turbomeca engine. World Airlines operates such a converted C-82 on a spur route express service to Europe and Africa. There are 800 C-119s in final condition—most of them in the USAF and Marine transport squadrons—and 45 C-82s, all in the civil service market.

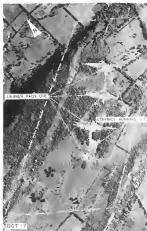
1960, and because of the Chinese Communist Indo-Chinese disputes along the border that "we are quite worried since this area is extremely difficult to reach and is situated in an undeveloped area 18,500 to 20,000 ft. up in the mountains" (AWC Dec. 30, 1960, p. 63). In contrast to the scarce inhabitants of the An Iu, the Indian air force is now operating the converted C-47s from two fields in the coastal area, one at 15,500 ft. with a 6,000 ft. dirt runway and the other at 9,000 ft. altitude.

100-1 Thrust Reduction Technique Shown

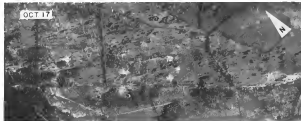


Latest Photos Show Speed Of IRBM, MRBM Buildup in Cuba

Heavily wooded ridge located near Gama-jan is devoid of any military activity at the end of August when aerial reconnaissance photos (left) was taken. Six weeks later, the same wooded ridge is focus of intense excavation and grading for construction of two intercontinental-range ballistic missile launch pads and two control blockhouses, one for each pair of launch pads (below, left). Two days later (below, right), construction of the blockhouses themselves is well along, and the launch pads are taking shape. This is one of two of Gama-jan. See other Cuban photos, pp. 14-15 for the other Gama-jan IRBM site.



Another former IRBM site, this one near Remedios in Central Cuba, shows nothing but wooded countryside early in September.



Six weeks later (above), intensive construction activity is under way. Ground has been bulldozed for launch pads, excavation has begun for semi-basement blockhouse construction, and a security fence now encloses the site. Concrete mixing plant has been built at right along the road. Two days later (below), the concrete launch plant at extreme right has been completed and is in operation. Concrete footings have been poured for upper sections of pads and blockhouses and working on the site for placing of cable conductors from blockhouses to pads. Areas east from bottom left launch pad, semi-basement structure is being covered with earth, probably for nuclear warhead storage.

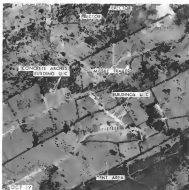




Large number of leaf breaks and visible weather breaks seen in this low level oblique photo of one of two medium range ballistics inside one in the San Cristobal area, indicating capability to support a suitable missile launch salvo. Launch pad in the background has a missile service under a canvas cover, a fluidized for guidance alignment and ejection to a launch control building.



Initial knowledge attempts are evident in a second, low oblique at San Cristobal. Knowledge setting moves five tracks at left and crosses five tracks from right. Note here as that in the low oblique to the previous page, but shows another branch god in opposition status with a red, threshold. Note cable to launch control via, out of sight to left.

[illegible]



Cherry-pick aerial of a single Nike-B missile just at the Sagua La Grande site shows it ready for operational use, with satellite dishes and firing rail in place, only four launch pads to control. Missile has been launched and fired, the missile being up the missile on its trajectory toward a major U.S. city 1,000 mi. away. Notice the camouflage netting and the cherry-pick mobile missile service gully. This is a drop-off of one of the two pads shown in other photos. Note tracks and one of the missile launchers being indicated presence of a missile in a high state of readiness. Camouflage netting is being stretched out over entire site to keep away from the site.



Russian Sputnik medium-range ballistic missile exploded in Cuba in a later version of this missile photographed during a Balisek missile attack on Moscow. New missile has fixed skin, smaller feet and internal plumbing, but general configuration is the same.

2 MILES DOWN WITH NO STRINGS ATTACHED

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Cuban Crisis Appears Far From Settled

Washington—Cuban crisis remained far from over last week in spite of indications that Russian technicians were rapidly dismantling Soviet missile bases there. Russian and Communist Chinese seemed close to support for Cuban demands that the U.S. withdraw from the Guantanamo Naval Base, raising the probability that this would still be at least long after the missile base question was settled.

Blockade and surveillance of Cuba were resumed by the U.S. on Nov. 1 after a two-day suspension while Acting United Nations Secretary General U Thant urged in Havana with Cuban Premier Fidel Castro about arrangements for UN supervision of the dismantling of Soviet installations.

Russian dispatches in mid-Port Dupuy, Premier Anastas Mikoyan to Cuba with an 18-page telegram on Nov. 2 brought speculation that he had

instructions to bring Castro into line with Soviet efforts to resolve the current crisis. But propaganda broadcasts by Soviet and Chinese government spokes reflected the opposite—strongly by both nations (asked the live demands Castro had done in readiness for accepting Soviet-U.S. attempts to settle the missile base issue.

U Thant had hoped to leave a part of his 17-hour party in Cuba to begin supervising the withdrawal of Soviet weapons. But the entire party returned to the U.S. and it appeared that Russian withdrawal to accept the weapons without letting any U.S. or UN observers visit them.

Soviet Chairman Nikita Khrushchev, in agreeing to their removal on Oct. 25, had not specifically agreed to President Kennedy's stipulation that the weapons be dismantled and returned to the Soviet Union "under United Nations

supervision." The wording of Khrushchev's reply (see box) left open the possibility that UN observers might be shown to more than abandoned sites after the missiles and Russian bombers were gone.

Premier Castro said shortly after the U.S. request for UN participation in the missile base line agreement that any UN observers who came to Cuba had better come "prepared for combat." Following the apparent acceptance by Khrushchev of U.S. proposals, however, he said he demanded dismantling—downed from Gromyko's, an end to the blockade and all economic blockades and penalties, in aid to air and naval space violations, missions, restrictions, etc.

U Thant said on his return from Havana that the talks had been "fruitful," but his statement indicated Castro still stood to the rest of any specific

Chronology of Events in Cuban Crisis

- Washington—Key events in the Cuban crisis were President Kennedy's speech of Oct. 22 denouncing content of Soviet offensive missile and bomber from Cuba (NW Oct. 25, p. 7) to have unfolded.
- Oct. 24—Blockade of Cuba begins.
- Oct. 25—Soviet all media broadcast announced blockade but was allowed to proceed. Missile payloads and chemical compounds capable of being used in power missiles added to list of prohibited goods. A dozen Soviet vessels turned back but others continued toward Cuba. Work proceeded on both anti-aircraft and intercontinental-range missile sites. Soviet Chairman Khrushchev told Acting UN Secretary General U Thant that Russian ships would leave the blockade. President Kennedy told U Thant that the U.S. would send monitors at any beyond the blockade but would the missile base must be removed.
- Oct. 26—Defense Intelligence Agency intercepted and located but allowed to proceed in Cuba with ground units. Radio signals, code indicating missile had been received but, before heading in, warning Cuba occurred in Washington. White House said "rapid" buildup of bases continued and intelligence officers had begun.
- Oct. 27—Strategic Air Command U-2 hit over Cuba (see p. 7). U.S. wanted it would permit disorientation. Khrushchev admitted bases were Soviet, but demanding in return of U.S. fighter jets have been in Turkey. Kennedy met the first time was dismantling at Cuban base. Blockade was defined (see box p. 7). Defense Dept. called right some more questions and the aerial transport operations of USAF Reserve to active duty effective Oct. 25 (incoming operations here that increase was sustained unless Khrushchev acted early).
- Text of a letter from Kennedy to Khrushchev, in reply to a letter that Khrushchev had sent on Oct. 19 but had not made public, revealed that the President was willing to end the blockade and give Russia assurances against invasion of Cuba if Russia agreed to remove its offensive weapons "under appropriate United Nations observation and supervision and suitable safeguards" and left the further introduction of such weapons systems into Cuba.

- Oct. 28—Moscow radio broadcast a Khrushchev message to President Kennedy, saying that the Soviet government, "in addition to earlier assurances on the discontinuation of further work on weapons construction sites, has given a new order to dismantle them" and states them to the Soviet Union. Khrushchev did not say UN observers could supervise the dismantling. Instead, he said "... We are prepared to reach agreement by mutual representation for the Soviet Union to verify the dismantling of the bases—possibly after the fact. Khrushchev also said he was prepared to exchange views on a relaxing of tensions between the North Atlantic Treaty Organization alliance and Warsaw Pact nations, and Russia did not shed doubt of responsibility for rendering aid to the Cuban people and would accept violation of Soviet and Cuban airspace (see p. 7). Khrushchev also said he was sending Yuriy V. Korotchenko to his special delegate to the UN.
- Cuban Premier Fidel Castro said a number of conditions the acceptance of a Soviet understanding with the U.S., including withdrawal of the U.S. from the Government would be met at all violations of air and naval space, and of "space attacks" from bases in the U.S. and Puerto Rico, and of "all subversive activities, kidnapping and looting of news and explorers by air and sea, organizations of sabotage, activities of spies and saboteurs..." and of "terrorism, blockade and all actions of commercial and economic pressure" from the U.S.
- Oct. 29—NATO Permanent Council announced that it had ended UNAF Gen. Louis Norment to the north and south. It is commander in chief, Europe, instead of retiring Nov. 1. Gen. Gen. Gen. L. Norment was to become commander of U.S. forces in Europe on Nov. 1, and would Norment in January. Soviet named Gen. Pavel I. Belya, former commander of acceptance forces in Hungary, in chief of staff of the post world forces of the Warsaw Pact nations. His presidency also would be that deputy chief of staff of Soviet main force.
- Oct. 30—U Thant and party of 15 went to Moscow for first talks with Castro. U.S. blockade and air surveillance were suspended temporarily.
- Oct. 31—U Thant returned with his party saying he had no table agreement that the bases were being dismantled and that dismantling should be completed by Nov. 2.

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Khrushchev Warns U.S. on U-2 Flights

Washington—Soviet Chairman Nikita Khrushchev has charged that a U.S. reconnaissance aircraft flew over Soviet's Chlenok Peninsula on Oct. 25 and has warned President Kennedy that similar or other Russian or Cuban aircraft could "lead to dangerous consequences."

Khrushchev's warning came one day after a USAF Strategic Air Command Lockheed U-2 was lost on a photo mission over Cuba.

President Kennedy issued the new resolution of Soviet anger on "an unusual reconnaissance case" and said "I expect this incident will end in a way that every reasonable man is likely to prevent recurrence." The President also said the aircraft, possibly a U-2, "was captured in the act of sampling in connection with our nuclear tests." Russia demanded a nuclear down at high altitude over Central Asia on Oct. 25 for a 60%.

No U.S. official has stated publicly before that U.S. aircraft were monitoring the Russian tests.

Khrushchev's charge came in his long message to President Kennedy on Oct. 25, saying to remove Soviet aircraft from the borders of Cuba. He told the President that "an aviation reconnaissance plane can be made into a nuclear bomber and the night path as to a fatal step all the more that the U.S. government and Foreign Relations have declared that was actually a reconnaissance aircraft plane."

The Soviet broke recalled France gave French U-2 flight over Russia in 1960 and the U-2 flight over Sakhalin Island last August. They charged that "a still more dangerous case" occurred over the Chlenok Peninsula, and asked the President if this was "a provocation," at such an incident line "when everything has been put on a nuclear mission."

He asked the President to "take appropriate measures to prevent this from becoming a provocation in the future."

Khrushchev then turned to the Cuban situation, and said he had learned "that our officers who are in Cuba" that the U.S. was violating Cuban airspace. He said he was concerned for the "officers, instructors" and other personnel there, and added:

"I should like to consider, Mr. President, that violations of the airspace of Cuba by American planes could also lead to dangerous consequences. And if you do not stop this line of action, it would be no more in your favor than it would be in mine. We must be careful now and refuse from such steps which would not be useful in the defense of states involved in the conflict but could only cause irritation and even serve as a provocation for a fatal step."

On Oct. 17, the Defense Dept. recalled the Oct. 23 violation of the Outer Limits of the Western Hemisphere imposed continuous surveillance of Cuba. The department said "any interference with such surveillance will cause irritation and interference will be refused." It expressed regret to ensure as whether any reconnaissance aircraft had been shot at.

Three days later, the department announced that a "military reconnaissance aircraft" was coming and passed but on a photo mission over Cuba. It related through late news to identify the type of aircraft, or to say what had happened to it. But on Oct. 26, Gen. Thomas S. Power, commander of SAC, notified the chief of USAF Maj. Gen. Andrew B. T. Jr., that his son was "being monitored and was not officially denied visiting in person." Gen. Power denied Maj. Andrew's Denial of the Department's report "the performance of one of the most important duties connected with the current crisis."

When Acting United Nations Secretary General U Thant returned to New York last week after two days of talks in Havana with Cuban Premier Fidel Castro, he announced the UN's opposition of the downing of a Soviet reconnaissance plane. He said:

"At my request, the Cuban government has agreed to return on humanitarian grounds the body of Maj. Andrew to the United States."

This was the first indication that Cuba had Maj. Andrew's body. The Oct. 27 announcement by the Department Dept. that a Soviet reconnaissance aircraft was shot down, p. 37) had caused speculation that Soviet reconnaissance aircraft had been downed by the U.S., but other reports said Maj. Andrew had been shot down and was to be returned to the U.S. to be buried. The government had refused to let news to clarify the situation.

President Kennedy said in his reply to Khrushchev's Oct. 25 message that the plane which flew over the Chlenok Peninsula was "without any military reconnaissance." He said in essence was direct from Eastern Air Force, Alaska, to the North Pole and return.

In turning north, the pilot made a serious navigational error which caused him over Soviet territory," the President said. "He considerably more in emergency landings on open roads, and was guided back to his home base by the most direct route."

arrangements. "There was agreement that the United Nations should continue to participate in the peaceful settlement of the problem," he said.

"During my stay in Havana, I was actually informed that the downing of the missile and the installation were slowly in progress that the process should be completed by Friday (Nov. 2). That is, I think, that the process would come then, and that it was to the Soviet Union, arrangements for which are understood to be in hand." Thant also announced that Cuba would return the body of a Strategic Air Command U-2 pilot whose plane was lost in a photo mission last week.

On Nov. 1, at the blockade and surveillance mission, Moscow Radio said in a broadcast in North America that Castro's "suggested mission" to return Cuba against harassment "would provide a good basis for a lasting peace in the Caribbean."

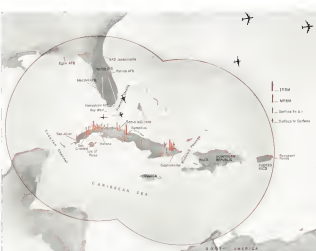
Two days earlier, Moscow Radio said U.S. military bases in Turkey jeopardize peace in the Near and Middle East" and said the interests of peace "require the liquidation of these bases." President Kennedy has accepted a long proposal by Khrushchev in which the U.S. would remove Jupiter missiles from Turkey in return for removal of Soviet weapons from Cuba.

While Radio took an even stronger position on Castro, saying, he stated "absolutely just, absolutely necessary and entirely correct," and urged him to continue to stand on his own position. But Castro's Minister of Foreign Affairs Cheo Y. said in a note to the Cuban chargé d'affaires in Mexico that the U.S. guarantee against an invasion of Cuba cannot be valid as long as the U.S. had not fulfilled Castro's demands.

"The struggle for Cuba is by no means ended," Cheo said. "The U.S. representative prosecution against you is also a prosecution against us."

Makarov's trip, which was to include a brief stopover in New York, was scheduled by Moscow as an economic mission. Also from this visit, it was reported that Russia intended to compensate Cuba for the loss of offshore weapons through some increase in commodity aid. Makarov's mission was considered by Moscow to be a political one. He is the Kremlin's top political troubleshooter.

U.S. reconnaissance aircraft flew over Cuba on Monday, Oct. 29. An aerial reconnaissance mission, the White House said, to say whether aircraft were involved. The Administration held comment on Cuban affairs to a minimum through the period of Thant's talks, but there was no relaxation of military readiness. President Kennedy met with the heads of all three services and sent three letters in two days with the ex-



HIGH AND LOW LEVEL. U.S. photo reconnaissance over Cuba by Air Force Lockheed U-2s and McDonnell RF-105s and Navy Langley-Vought F-4U-19s documented the latest Soviet missile buildup on the island. Shaded areas located include intermediate range ballistic missile emplacements near Camaguey, Remedios and Sagua La Grande, and medium range ballistic missile sites in the San Cristobal and Sagua La Grande areas. At least eight ballistic missile sites at both types were located. Map also shows 24 intermediate

range missile sites, six medium range ballistic missile sites and the San Cristobal missile site where Russian U-2s flights were being monitored. Soviet missile sites on two 900 sq. mi. radar sites, one located at Havana and one on the eastern tip of Cuba. Strategic Air Command Boeing B-52s and Navy Langley F-4U-19s have been beyond this zone into the Atlantic to monitor shipping approaching Cuba. Also shown are bases in Florida being used by the U.S. to increase its buildup.

range missile of the National Security Council. The two meetings in one day coincided with U Thant's return from Cuba.

The U.S. still has not ruled out invasion of Cuba if Castro should further advance the political situation elsewhere in Latin America—now though Soviet offensive weapons might have been withdrawn. Administration sources believe Castro has the technology of Venguet and production plants that followed Khrushchev's decision to remove Russian weapons.

If the Cuban situation should be

settled to the satisfaction of the U.S. and Russia, however, government sources here expect that Kennedy and Khrushchev, will have a constant meeting sometime this year. The real report of such a meeting would be that, however, and not Cuba, officials here believe. If and when Russia makes a move into for Berlin, the North Atlantic Treaty Organization will be under the greatest pressure. In late Kennedy and Khrushchev discussed an easing of tensions between NATO and Warsaw Pact countries in their exchange of notes on Cuba.

Mariner 2 Trouble

Interplanetary mission experiments in the Mariner 2 spacecraft were tested off by ground command Oct. 30 because of wiring regulator trouble but National Aeronautics and Space Administration expected these experiments and two subsequent experiments to test an auto-actuator to be in before the spacecraft leaves Venus on Dec. 14. The next test occurred in the 60th day of flight with the vehicle 11 million miles from earth.



First Batch of F-104Js in Final Assembly

Twelve F-104Js are in final assembly at the Boeing plant of Mitsubishi Heavy Industries Corporation, Ltd., prime contractor for Starfighter production in Japan. One aircraft has already been delivered to the Japanese Self Defense Agency, 12 other F-104Js are in sub-assembly at Mitsubishi Ota plant and 11 Kawasaki Aircraft Co.-prime subcontractor in production progress. Overall, 208 of the aircraft have been purchased by the Japanese.

Most Aerospace Firms Unaffected By New NASA Patent Proposals

Washington—National Aeronautics and Space Administration will hold a public hearing Dec. 10 on a proposed amendment to the existing of patent title to inventions to promote independent use of space invention.

The proposal circulated last week, would give the claim for patent title claims by NASA contractors that are not businesses, or non-government. It would limit, little effect on aerospace firms whose work, it said has been previously for the government.

The proposal first lists three categories of inventions for which NASA will waive patent title to the contractor. It then stipulates that NASA will keep title to "inventions in a field which has grown predominantly as a result of government sponsorship." This classification would embrace most aerospace firms.

Patent Titles

Under other types of invention for which NASA would also keep patent titles are:

- **Inventions** which, to be covered by an act or regulation for public use. An example would be a safety device for aircraft required for all commercial planes by government regulation.
- **Inventions** primarily related to a government program designed to develop goods and services for use by the public. This would include communications

satellites designed for noncommercial uses.

The three invention categories eligible for title claims by NASA would be:

- Those that fall within the established commercial use of the contractor.
- Inventions which would require such a substantial expense to develop that exclusive ownership would be warranted as an incentive.
- Inventions for which the contractor had filed a patent application before joining a NASA contract.

Licensing Regulations

NASA also put into effect last week new licensing regulations for patents held by NASA. Under these, NASA can grant non-exclusive, non-time limited to all applicants within one year after the receipt of a patent. If the licensor did not commercially develop the invention within the two years, then license may be revoked and an exclusive license granted to a single firm to encourage development.

NASA Administrator James E. Webb anticipated that the new licensing regulations and the action proposed will contribute to NASA's objective of developing the full potential for commercial purposes of the technological advances which, as developed, of stimulating research, and of providing services for them.

New Semiconductor Laser Is Developed

Discovery of a new type laser which produces coherent infrared radiation from a semiconductor could be direct solution with extremely high conversion efficiency has been reported by scientists at the General Electric Research Laboratory, Schenectady, N. Y., and by scientists at International Business Machines' Watson Research Center.

The new laser achieved coherent emission from a gallium arsenide diode, coupled to liquid nitrogen by helium ion pump, at a wavelength of about 8,400 microns. Laser action occurs when a voltage is applied to the diode.

Several months ago Lincoln Laboratories scientists discovered that the application of a voltage to the most common diode to emit infrared radiation at the same wavelength (AOM 10¹⁶ cm⁻¹, p. 74). But they did not report it as a diode laser because the diode, the characteristic which distinguishes the emission of laser and makes them of such widespread interest.

GE scientists adopted an action to construct the gallium arsenide diode in an optical cavity, with parallel reflecting mirrors which encourage the building up of coherent radiation. GE also also effected improved control of the properties in the gallium arsenide crystal.

Compared with conventional processes and crystal lenses, which so far have been used to construct only about 15% of their beam energy into coherent output, Lincoln Laboratories researchers used an incoherent source from gallium arsenide diode achieves a conversion efficiency of nearly 100%. This suggests that the new laser may open the door to extremely high power lasers.

In GE experiments scientists have applied currents as high as 30,000 amp per square centimeter of crystal surface, but these have been applied in periodic pulses of 5 to 10 nanoseconds duration to prevent overheating and damage to the semiconductor crystal.

IBM research scientists have been working with current densities ranging from 10,000 to one million amperes per sq. cm, also applied in short pulses.

Evidence which indicates that coherent radiation is being produced is shown by the sharp lines in the spectrum of the emitted radiation, the sharp increase in beam intensity when a narrow slit is placed in the beam, and the pronounced narrowing of the spectral distribution of the beam.

Another important advantage of the new type laser is that it is far easier to modulate at high frequencies than previous types. The laser can be modulated directly by modulating the voltage applied to the diode.

North American Must Repay \$16.5 Million

By Katherine Johnson

Washington—U.S. The Court has ordered North American Aviation, Inc., to repay \$16.5 million in excess profits on government contracts for 1955 and 1956. The figure, after \$3.5 million has been paid originally sought by the Renegotiation Board.

In its opinion, the Court gave a commanding endorsement to North American's efficiency and the quality of its products—principally the F-105 and F-100 fighter aircraft—and severely criticized the Renegotiation Board for not recognizing these facts.

It was the Tax Court's second major renegotiation decision. The last, issued close to January, required a \$11 million refund by the Boeing Co. (AW Jan. 22, p. 32). It is still being handled, and Boeing's response to the pending problem for a change of venue from here to Seattle, Wash.

Other aerospace cases pending before the Court total over \$10 million. These include \$24.7 million in additional determination against Boeing and \$11 million in additional determinations against North American.

North American filed suit before the Board was the Court. The \$16.5 million refund was \$9.5 million less than the \$26 million originally sought by Renegotiation Board, and \$21 million less than the \$47.5 million sought by Justice Dept. when it brought suit.

The \$17 million demand against Boeing was \$3 million more than Renegotiation Board's original \$10 million determination.

North American said that under the ruling, its net loss of profits after taxes would be \$5.8 million. The company estimated its net loss after taxes under the Board's original \$26 million determination at \$6.4 million.

Under these estimates, North American stands to gain \$1 million in profits as a result of the judicial decision which has been made about six years after the Board issued its order on the company's 1955 business in February, 1957, and its 1956 business in April, 1957.

The case outstanding before the Court's opinion was the uncontroverted and extensive price gouging North American's performance and the terms, criteria that Renegotiation Board for renegotiating it. The Court noted that favorable conditions for maximum performance is mandatory under renegotiation law, and indicated that this was a major factor in its reduction of profit refunds asked by the Board and Justice Dept.

"As to efficiency of operations, quality

of products, ability to meet production schedules and pricing on government contracts," the opinion declared, North American "has at all times been naturally stood at or near the top of the aircraft industry." In general, as a factor of military necessity, it was stated, North American during 1955-56 "was not inflated by any other means of the industry and called by any law, 4-5."

The Court fully agreed Renegotiation Board's contention that North American "in the performance of some of its major contracts... was inefficient in its operations, that the quality of its products was inferior, that it failed to reduce costs and was not concerned in the use of materials, facilities, and manpower."

The Court said "The evidence at hand... is overwhelmingly in favor of the finding that at least some of these categories North American was at or near the top of the aircraft industry."

North American's profit picture for 1955-56 was:

- On sales of \$644 million for 1955, the company earned a 6.5% profit for 1955, \$646 million sales yielded \$5.2 million.
 - On book net worth of \$17 million in 1955, the company's net worth was \$28 million.
 - In 1956, the net worth was \$35 to \$60 million book net worth.
- On the personal controversy, over whether profits should be awarded on a gross or net basis, the court reaffirmed its middle road position in the Boeing case. It doubled North American's book net worth and added to it the net worth in the book—to reflect the company's assets in "know-how" and gave a more realistic picture of net worth.

In commenting on Renegotiation Board's previous decision that North American's profits were excessive be-

cause they constituted an unreasonable return on book net worth, the Court explained:

"However, in our consideration of this factor we have... mentioned [North American's] net worth figure by the value of its design and manufacturing know-how, which we feel is of the value of all its book assets combined."

The predecessor of North American's 1955-56 business, creating \$646 million net worth for 1954-55, Schlenger Aircraft Order sales were:

- F-105 and F-106, Navy version of the F-105 series—\$170 million.
- A-2F Navy long-range reconnaissance and A-1F Navy photo-strike aircraft—\$16.5 million.
- F-100A advanced fighter equipment for the Pratt & Whitney J-57 jet engine—\$46.5 million.
- Rocket engine—\$24.6 million.
- Electronics and electro-mechanical equipment—\$96.3 million.
- Atomic energy projects—\$12.7 million.

The Court challenged Renegotiation Board's contention that the F-105 series, its Navy version, and the F-106 were all "of inferior quality."

"The evidence as a whole reflects, among that the F-105 series 'performed in the field of modern fighter aircraft. They were used extensively in the Korean conflict and were the backbone of the United Nations forces. The military use of the F-105 over the Russian-built MIG-15; it was the backbone of the U.S. air defense for several years thereafter."

"The F-100 was the first operational airplane to exceed the speed of sound in level flight... This achievement is considered a milestone in the development of aviation."

"The F-105 and F-106 were used as the best Navy fighters of their time," the Court said. "All of these airplanes constituted full staff of production and all of the witnesses agreed that no perfect airplane has ever been built—but that since this type of their type is cheered up to that time."

The Court commented that North American "showed considerable ability and transformations in improving quality and performance of its airplanes."

The Court ordered Renegotiation Board for writing to deny North American "any credit whatsoever for contributions to the defense effort in the production of its airplanes in 1955 and 1956."

Record NASA Contract

Washington—National Aeronautics and Space Administration has awarded a record \$10.8 million contract to North American Aviation, Space and Defense Inc. for development and production of the S-2 second stage of the Saturn C-5 launch vehicle. It is the largest single contract yet awarded by NASA.

North American was awarded a year ago a stage contract (AW Sept. 18, p. 26) and also has been developing the stage under a preliminary contract. The S-2 will be powered by two J2 engines developed by North American Rocketdyne Division.

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SHORTLINES

► **Aviation Chaimson** J. R. D. Tate re calls plotted a 10-day flight high wing Lomax Mach monoplane between Kansas and Boston in 7 hr to one economic leg 30 days ago that began India's first scheduled airline service.

► **Air Transport Assn.** has renewed its drive to have scheduled airlines handle all first-class and between major cities operated by individual airlines. ATA President Stuart G. Epton said that the ability of airlines to move first-class has been proved over a seven-year experimental period.

► **Allegany Airlines** has reported a 21% increase in the number of passengers carried for the first nine months of 1962 over the same period last year. During the same period, cargo volume increased 13%.

► **American Airlines President** C. B. Smith has predicted that the United States will build supersonic transports "because we cannot be without them" but that they will not be in scheduled passenger service within the next 10 years.

► **Basulf Airways, Northeast Airlines** and **Norfolk Airlines** will open their new joint terminal at New York International Airport within the next two weeks.

► **Contractual Air Lines** last week reported a net income of \$775,000 for the first nine months of the year, compared with \$502,000 for the same period last year. Third quarter profit was \$181,000, compared with \$146,000 in 1961's third quarter.

► **Eastern Air Lines' AirSouth** is cited as an on-time record of 98.3% from Apr. 10, 1961 to mid-October this year. In September, the Air South's airplanes handled more passengers than in any single month since the service was started 15 months ago.

► **Pan American World Airways** showed a 51% increase in the volume of first-class air travel last month over the first nine months of 1962 compared with the same period last year.

► **U. S. trunk and all-cargo airlines** flew 41.5 million ton miles of air freight in domestic operations during September, or a 13.1% increase over the 36 million ton miles carried in the same month last year.

AIRLINE OBSERVER

► While House study group has positively concluded that more of the problem cited by international critics regarding relations with foreign airlines is an internal one, the House committee on transportation in a policy for U. S. international air transportation contract to be placed to let the airline industry move its first class of the policy developed from the original study (AW Oct. 29, p. 48). That concept is that the industry will re-evaluate, probably within the study group's findings suggest that not only and within support of the policy as it is now conceived.

► **Watch for Federal Aviation Agency** to publish a proposed rule that would require U. S. airlines to install improved landing gear warning systems in all transports. In current airline reports, when throttle is situated beyond a certain point and landing gear is either up or not fully extended, a horn sounds. FAA feels that pilots should be given still greater warning of possible gear malfunction, perhaps through an independent, supplemental system. The rule, if enacted, probably will apply to all U. S. aircraft with retractable gear.

► When **American Airlines** announced its plans to purchase four Boeing 720C turboprop airplanes for its all-cargo dispatcher service (AW Oct. 29, p. 48), another major turboprop was in the middle of a series designed to prove that a fleet of all-cargo jet transports would be profitable.

► **United Air Lines** has reduced depreciation expense on its jet fleet by extending the depreciable life of four-engine jet aircraft from 10 to 14 years. Depreciation expense for the first nine months of 1962 thus was reduced by \$1 million to income earnings for the period by \$1.1 million. Residual value of the aircraft has been reduced from 18% of the original cost of the aircraft to \$104,000 for each 747 and \$1,000 for each propeller. United's net earnings for the first three quarters of the year totaled \$0.1 million.

► **Length of average passenger haul** on Soviet Russia's state-owned airline Aeroflot is shorter than the average passenger haul by U. S. scheduled airlines, according to data released by the Soviet for the first time. In 1961, average passenger haul by the Russian carrier was 467 mi., compared with 551 mi. by U. S. domestic airlines. Aeroflot still has relatively little long-haul traffic since Russia's largest load carrier—Soviet—operates with U. S. transcontinental routes. Soviet overseas long-haul international business is also relatively small. While the U. S. scheduled airline industry's average passenger haul has increased steadily during recent years, Aeroflot's average haul remained fairly constant. In 1960, it was 469 mi., 1959, 465 mi., and 1958, 461 mi.

► **Communist China** has reported the opening of regular passenger air service between **Vladivostok, capital of Laos, and Peking, capital of Cambodia.** Initial frequency is one flight weekly.

► **Swedish-Swedish Airlines** Section pilots plan to demand less flight time and better pay to offset the increased stress of an expansion. Pilot groups are now studying a complete study of medical problems involved in long distance, short international jet flights.

► **Japanese government** has told the Soviet Union that **Boeing** select tests in the Pacific will seriously impact operations of Japan Air Lines and cause a heavy financial loss. Japan asked that Russia select it 5% for future each test to keep losses at a minimum, and demanded that compensation be made 24 hr. prior to launching. The tests, which began Oct. 16 (AW Oct. 22, p. 27), are to continue through November.

► **Local service airlines** was divided in their reaction for rejecting the truck carrier's new service plan. Cost of adopting the plan would be particularly for most business of the small local cargo hauler. A few local airlines are among the operators of the plan as a sales technique to attract more passengers. Meanwhile, some truck carrier have suggested they may drop out of the plan if local don't accept it.

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Sabena Will Resume Helicopter Schedules

Rome-Sabena World Airbus is serving its international scheduled helicopter service on a scheduled basis despite an earlier ruling by the court's board of directors to suspend the four-year successful operation for an indefinite period (AW July 13, p. 10; Sept. 10, p. 13).

New decisions, largely prompted by appeals against the planned suspension from a number of cities along the route structure, won rights after Sabena had sold its fleet of eight Sikorsky S-55 helicopters to the Belgian air force. Two of these are being re-converted to the airline as a lease basis to provide a temporary network with a total of 27 second trips per week.

Notwithstanding the planned suspension of the service at the end of 1962, current schedules had scheduled 18 times. Times scheduled under the new plan are: Pisa, Ancona and Dortmund, West Germany. The schedule, which became effective last week, provides for four flights from Rome.

- Three a week to Frankfurt, Germany, via Cologne, with an optional stop at Bonn, Belgium, and/or Luxembourg, Holland.

- Six a week to Cologne, also with an optional stop at Bonn and/or Luxembourg based on passenger demand.

- Six a week to Rotterdam, with an increase to 12 per week under a new schedule which becomes effective Feb. 4. All flights will include stops at Eindhoven, Holland, a major passenger point on the network.

- Twelve a week direct to Eindhoven. Sabena spokesmen say that scheduled air plans for next summer, when the traffic potential should rise sharply, are being held in abeyance until the court can determine just what types of helicopter can be available on a lease basis. For this period, the airline would like to obtain more economical turbine-powered equipment to replace the S-55s, possibly the Boeing Vertol 107.

BOAC Investigation

London—Minister of Airline John Aneur has contacted with private law firm of anti-trust public accountants to carry out an investigation of alleged financial shenanigans of British Overseas Airways Corp. Aneur has the support of Sir Matthew Strickland, BOAC chairman, who previously alerted to BOAC's financial "blood-letting" (AW Oct. 15, p. 34). Strickland has been probing for general permission to comply with all capital costs of the aircraft & fleet, and, Court 44 and British Overseas Airways have taken charge.

SCIENTISTS AND ENGINEERS: Today, Motorola digital systems and equipment are providing fresh and fruitful solutions to problems of communications, command and control for... the Air Force data acquisition and relay system at the Edwards AFB high speed flight corridor... the NASA/JPL Mariner and NASA/McDonnell Douglas spacecraft digital command systems... and the Navy/Oryx/DASH deep-sea helicopter control system. Current studies also encompass random access digital communications, digital-to-voice translation, and ACCESS, a combined digital/voice approach to air-ground-air communications. If you are interested in shaping the future on these or other challenging programs, write today describing in detail your experience in the following areas:

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Low-level oblique photo of Soviet NERVA line at Sagua La Grande, Cuba (see cover for closer view) shows launch pads for the Soviet 1,000-ton, air-creep liquid-fueled missile, carefully sited for blast protection from rocky ridges. Hydrogen peroxide plant serves mobile launch units parked at foot of wooded ridge for easy maintenance. Both launch pads shown here are in operational status with control, fuel, and electrical systems. Some debris and service gully in place. Cubans connect the firing unit with control cable to launch control center in wooded area.

Low-Level Photos Pinpoint Cuban Missile Sites

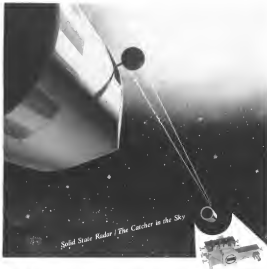


Soviet Krasna built Krasna class PF boats are shown at docks alongside large coastal defense and port facilities to be used for servicing nuclear warheads from Soviet ships for Cuban use only. Krasna boats each carry two missile launchers for short-range solid-propellant missiles, plus infra-IR and radar sensors and a forward turret. Soviet fighters rarely allowed for Cuba in only October before the U.S. blockade cut off flow of offensive weapons to Cuba states daily lead of control B-25 bomber launchers for via Japan attack (AW Oct. 25, p. 28).



NERVA line (above) under construction near Sagua La Grande, Cuba, to launch 1,000-ton, air-creep liquid-fueled missile shows two "soft site" launchers built into wooded hillside with cable ducts leading to central control building. Nuclear storage bunker is sited into heavily wooded hillside and surrounded by heavy wire security fence. Low-level oblique photo (below) taken by Navy F-4U-1P shows cluster of missile checkout buildings at a Cuban NERVA line with a canvas-covered ejector housing a Soyuz type missile.





A new solid-state radar system built by STL, encounters and identifies air craft and its microwave signals at X-band (a quantum to help their comprehension and detect subleakage space STELARAC is at hand. It is the first solid-state system of its kind. The X-band transmitter is shown above. It has successfully passed temperature and vibration tests. STELARAC can also be used as a command link between vehicles in flight. By altering its multiple design, the flexible radar system operates as an altimeter and Doppler velocity sensor to guide spacecraft safely to the surface of the moon and planets. Today STL is busy on many such projects as STELARAC. STL is also prime contractor for NASA, DOD and a new class of classified spacecraft for Air Force, ARPA, and STL continues Systems Management for

Dr. Peter A. Tiers and Missions program. These activities create immediate openings in Theoretical Physics, Systems Engineering - Radar Systems, Experimental Physics, Applied Mathematics, Space Communications, Antennas and Microwave, Inertial Guidance, Analog Computers, Solid State Physics, Computer Design, Telecommunications, Space Physics, Digital Computers, Guidance and Navigation, Electromechanical Drives, Engineering Mechanics, Aerodynamics, Propulsion Systems. For Southern California or Cape Canaveral positions, write Dr. R. C. Potter, Department A34, One Space Port, Redondo Beach, California, or Box 4377, Patrick AFB, Florida. Your inquiry will receive a prompt reply. STS is an equal opportunity employer.



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ARB Chicago/IL • Los Angeles Interviews November 12-13, Call R. C. Nagel, DAJ 7-5132 Visit STL South 326.

Weather Forecasting Aids Noise Control

(The following description of nose problems associated with today's large aircraft was written by Anthony Work and Space Technology in Rockford, N. Tishback and Wade D. Dodson of National Aeronautics and Space Administration's Stennis Space Flight Center. The report is based on the experience Mitchell has obtained in water tests of the Kerosene (K) Aerosol stage.)

Rapid increase in size of nuclear reactors during the past few years, and the resultant increase in the waste level generated by static frags and launchers of these reactors has made the production and control of sound generation an important phase of atomic development. This has particularly been true in the case of the Saturn S-4, which has been described as the world's largest man-made steady state noise generator.

Most sources of sound are created by vibrating bodies causing disturbances in the air. Other sources, such as the Saturn booster, generate sound by vibrating rapidly moving hot gases into the atmosphere. Such sounds have become relatively familiar to most Americans with the advent of both military and commercial jet aircraft. Rocket noise is not too subtle that from a jet, except that it is usually lower pitched than the jet's distinctive whine.

The noise environments which can be expected from the test firing of legs and rails have now become important considerations in planning test sites and the surrounding supporting community.

One can consider the problem in terms of three distinct parts, each of which must be solved to achieve a complete solution. The first of these is the noise source itself. The Sakurai group has a tremendous volume of evidence pointing toward a supersonic jet engine as the noise source moving through a relatively thin atmospheric mass. Large amounts of low frequency sound is being generated. Part of the answer to reducing noise levels might be in modifying the noise produced at the jet itself, thereby reducing the amount of energy being injected into the atmosphere. However, for the present, to begin and larger boosters are being developed. This concept is suggested as the more solution to the problem.

The varied aspect of the social situation concerns the shifts in the social status which the system communicates, which always spring up around the major muscle site. The most observed relation in this is enough to last up all of the land around the muscle line, for about twenty years. Unfortunately, this is not often feasible since most of the time was begun a few years ago when studies and muscle work were not so much as large. As a result, small sites were built up within a few miles of some branch and other test facilities.

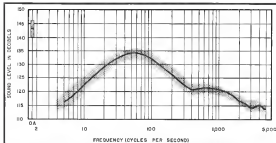
Another solution to this matter of the transmission of music sounds concerns the role of weather in such situations. It is possible to greatly lower the sound level at a great

iniles distant from a sound source simply by choosing the meteorological conditions under which the test is to be performed. Similarly, the sound pressure levels can be raised naturally by good propagation conditions at the time of a test. It is in this particular field where the best results can be obtained for most control.

[illegible]

The racket schools, both pasted and exposed, had seen its reception here presents a sadistic weapon. With the impact of various development, these schools was little concern with children's discomfort. Also, once the early racket was relatively small, to give the search. The amount of interest "but for" had certainly shifted around. Later, institutions to maintain its suitable military academy proved in most instances to be quite satisfactory in otherwise the sound of music from

(Continued on p. 63.)



GRAPH SHOWS TYPICAL SOUND SPECTRUM at a point 500 ft. from static test site for Sertum. Solid line shows average of recorded

HONEYWELL SYSTEMS



Under the sea it's under stress, like demand for more sophisticated navigation systems continues to grow. Honeywell's goal is to advance the art and science of guidance and navigation equipment and continue to produce quality systems at the lowest costs.



CHOSEN FOR TOUGHEST NAVIGATION PROJECTS

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For tomorrow's systems capable of performing maneuvers in space maneuvers, Honeywell offers a wealth of experience in the development of navigation systems. Many of our nation's most demanding projects are using Honeywell developed guidance and control systems. Gemini, SD-5 Chaper, and X-20 (Dyna Soar). Honeywell is also building guidance systems for Pallas.

As space maneuvers become more and more complex, the guidance equipment aboard the various vehicles must be capable of more complicated maneuvers. Systems are needed that do more and weigh less. Today's sophisticated systems must precisely measure everything that happens to a moving vehicle and

guide and control it with precision on an exact course from one place to another, almost anywhere in the universe. All this is done independently of any earth-based equipment. The need for accuracy is most vital. (A slight error can throw a vehicle thousands of miles off course.)

Honeywell has pioneered in all phases of design, development, fabrication, test and use of such inertial guidance and navigation systems and components. The tasks have been many and varied. They range from expensive to tremendous to routine navigation.

Currently, many advanced navigation systems are under development at Honeywell. We can manufacture inertial platforms (one third the size of conventional ones,

some platforms are now being needed) and offer complete capabilities with no sacrifice in performance or reliability. Components such as miniature computers and components are also being developed.

Honeywell navigation systems are adaptable to either analog or digital modes. They can incorporate star trackers, horizon sensors, infrared and other optical components where needed for special applications such as space guidance and deep space maneuvers. In addition to complete systems, Honeywell can supply computers, computer components, inertial platforms, and inertial components built to your own or to Honeywell's design.

For more information on how Honeywell can assist you in the development and/or manufacture of navigation systems, contact your nearest Honeywell Military Products Group representative, or Minneapolis-Honeywell Aerospace Division, 13320 U.S. Highway 19, St. Petersburg, Fla. Phone: (813) 551-1111. Honeywell International Sales and service offices in all principal cities of the world.

X-20 (Dyna Soar) to be guided by Honeywell system

The Air Force's X-20 (Dyna Soar) program, presents challenging guidance and flight control problems. A Honeywell system will supply accurate navigation, guidance and pilots display information from self-contained measurements and computer work made within the glider. By means of this display, the pilot is able to evaluate the capability of the glider, heading it given selected destination and, if necessary, call down on other in-flight mission. The system will operate from launch and landing and provide uniform control of the craft through a vast range of speeds and altitudes.

Honeywell developed guidance and/or



Flight control systems are also in use at sites for use on the X-15, Mercury, Gemini, and Apollo.

Honeywell project: exploring the art of celestial navigation

Open to the key to the future in celestial navigation of space vehicles, and digital devices of many types and varied uses are being developed at Honeywell. One system being studied would actually track several planets by means of high-powered radio like laser devices. Range and range rate to the planets would be determined by the breaking down and the information used to orient the vehicle on its proper course.

Consistent with celestial navigation systems development, other far-reaching new ideas are being considered and evaluated to determine Honeywell's leadership in the navigation and guidance field.

Honeywell system guides Army SD-5 drone

For the Army SD-5 drone Honeywell does the Honeywell designed, designed, and is manufacturing the inertial navigation system. This compact device can find its way hundreds of miles behind enemy lines, locate battle area targets and report back on its location and mission.

The system now guides the drone over terrain target areas in each flight without need for any radio or radar commands from the ground. After completion of its mission the Honeywell system guides the drone to its home base. The SD-5's inertial navigation system is an all-in-one, self-contained unit. And because the system is completely self-contained it is not subject to "jamming" or interference by enemy countermeasures.

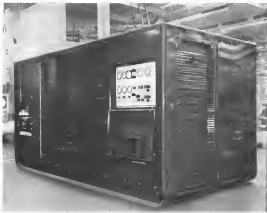


Honeywell



Military Products Group

Engineers and Scientists. Customized professional capabilities. With Honeywell of defense, space,



Automatic temperature control GSE for Titan II missile propellant

This new environment control package was designed and produced by Hamilton Standard for the Air Force's Titan II missile, made by Martin. It automatically stabilizes propellant temperature at 60 ± 5°F within a 20,000 gallon storage vessel. The unit electrically heats or mechanically cools a glycol and water heat transfer liquid, and then circulates it to the storage vessel heat exchanger. It is built to perform reliably in ambient of -35° to +115°F, and from sea level to 6,000 feet.

The Titan II Propellant Temperature Controller is evidence of Hamilton Standard's ability to meet

environment control GSE assignments. It is precise, results attainable when engineering capabilities in pneumatics, hydraulics, electronics, and packaging, are combined with specialized manufacturing skills.

A NEW BROCHURE describing Hamilton Standard's environment control GSE capabilities for aircraft and missiles is available. To learn how this solid foundation of experience can be your key to dependable GSE, write: Sales Manager, Ground Support Equipment Department, Hamilton Standard, Windsor Locks, Connecticut.

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However, the development in recent years of larger rockets such as the [space] Atlas and Titan has assured that occasionally some a minor incident would be picked up at their day. Nonetheless, the importance of the program to the national defense provided very much shifts in other tests, areas or test vehicles get because of the issue.

Chickie Program

With the creation of the National Aeronautics and Space Administration, a large civilian rocket program was on orders for the first time, which, because of its very recent, and remains available to contemporary machines. Assigning the responsibility for large booster development to Marshall Space Flight Center focused the same problem from those vehicles on the way, supporting that mission. Since the city of Huntsville, Ala., has 510 mi. northeast of the Saturn site, the coast from each state test has necessarily been set aside, but left in Huntsville.

It was found that this has been due primarily to the weather conditions under which these tests have been performed. When strong irregularities in a vacuum have been considered by which toward the site, this sound is actually located meteorologically early in the same manner as sunlight is located by a measuring glass. This has, in fact, resulted in some of the Saturn test site being in a very poor position in both the business and industrial areas of Huntsville of up to about one hundred times normal. However, exactly opposite conditions have also existed and at those times not only a whopper of the Saturn test site has been.

Amount of Noise

It has also been learned from experience that the knowledge of just how much is allowed or placed when it has been determined. Therefore it has become standard procedure to announce to the test engineer, radio and television stations when a test will be held.

It has been found that about one-half of one percent of a rocket's power goes into the form of acoustic energy. This amounts to nearly 40 million watts of acoustic power for the Saturn. (A 1/2 set of radio produces usually about 25 watts.)

However, the larger the space vehicle which is being tested, the larger is the amount of sound which is radiated into the atmosphere.

However, there are two additional factors which greatly affect the response which may be anticipated from the surrounding communities. One of these is the frequency content of exposure (which, pp. 96, 97, 99). It has been shown that as threat of

How you can avoid three costly mistakes in the selection of a scientific or engineering computer

And the one sure way to find the computer that suits you best

Selecting a computer can be one of the most important decisions an executive can make. Almost any computer can reduce costs by solving problems, and saving time, but some are far more efficient than others.

Too often, the low-level scientific study of available computers. And the study must avoid becoming overwhelmed with "facts and bells" and not consider instead on overall suitability and design.

Basically, the decision must be made on the computer that best serves your needs. The [computer] line of solid state scientific and engineering computers has been found to be many times more reliable. And the same guidance in your choice.

(1) "Get the cheapest computer"

Just as there is no such thing as a cheap pair of shoes, there is no "cheap" computer. Realistic scientific and engineering computers sell from \$40,000 and up. They range from \$1,000 and up to \$10,000, but, much more important than price, is what a computer will do for you over a period of time.

A computer feasibility study showed that a [computer] computer could save almost \$100,000 more than a [computer] computer in a year or so. The [computer] computer is used for small scale studies. And you can have one for \$1,000. Computers for medium scale work. Reasonably, you can have a [computer] computer for \$1,000. And you can have a [computer] computer for \$1,000.

(2) "Buy the fastest one"

Mathematically speaking is important. But computer speed is just a small part of the story. Fast is a low rate of change. And there are many [computer] computers. And there are many [computer] computers.

The [computer] line of solid state scientific and engineering computers has been found to be many times more reliable. And the same guidance in your choice.

(3) "Use specialized computer personnel"

Not always necessary. Some computers do general operations. Some computers do general operations. Some computers do general operations. Some computers do general operations.

One of the most important factors in the selection of a computer is the [computer] computer. And you can have a [computer] computer for \$1,000.

The [computer] computer is used for small scale studies. And you can have one for \$1,000. Computers for medium scale work. Reasonably, you can have a [computer] computer for \$1,000.

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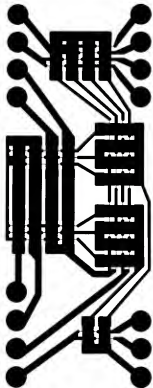
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NEWS ... OF DEFENSE TECHNOLOGIES

GUIDANCE

There are vast differences between the techniques required to guide missile flights and those needed for space vehicles. Entirely different problems are presented in the tasks of guiding an anti-air missile having a few thousand yard range, sending an ICBM to a target thousands of miles away, and landing men and equipment in the frontiers of space. Experience in each is invaluable in satisfying new missile requirements.

General Electric is producing infrared guidance for the Sidewinder, nuclear guidance for the Polaris, and the radio-command system for Atlas ICBM's. It was this phenomenally accurate radio-command guidance that helped put the Mercury-Atlas into earth-orbit.

This wide range of guidance experience is enabling General Electric to apply new devices and techniques (such as electro-optical gyro and cryogalvanics) directly to existing problems, thus providing continuous and significant upgrading of guidance technologies and capabilities. Current activities include development of reference navigational systems for space and exploration of the best combinations of basic guidance forms for the sophisticated missiles and space vehicles of the future.



CYTOSINIC PROGRESS in inertial guidance is typified by this 33 gyro loop element for smaller, faster, more reliable computers. Other inertial systems which include high precision gyros and accelerometers



EMITTERLESS GUIDO are being developed to meet future requirements for maximum up to 1000 times greater than those attainable with present gyros. Other advances will be simplicity and long life.



SLANG-22 TRACKER combines a spaced star pattern against a celestial reference map for spacecraft attitude control. This device may replace the complex radio to no other launch vehicle of its size.



INTELLIGENT GUIDANCE for Polaris has been extremely successful. Designed by MIT and produced by General Electric, the inertial guidance system will help to extend the range of the advanced Polaris missile to 1000 miles.



RADIO-COMMAND GUIDANCE, already operational and proved in combat and reliable in ICBM and orbital vehicle flights, is currently being applied to future programs and missile range and navigation.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

DEFENSE ELECTRONICS DIVISION

Why our storable liquid motors outperform some others



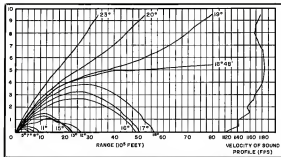
CHEMICALLY SPEAKING, OUR STORABLE LIQUID PROPELLANTS ARE PRETTY MUCH LIKE OTHER PEOPLE'S STORABLE LIQUIDS. STILL, UTC MOTORS (ISLATION-GOLOS, PRESSURE-ED, WITH FILAMENT-WOUND FIBERGLASS CASINGS) CONSISTENTLY OUTPERFORM OTHER MOTORS USING SIMILAR HYPERGOLIC PROPELLANTS. WHY? BASIC DESIGN PROVIDES OUR STORABLE LIQUID PROPELLANT MOTORS WITH EXCELLENT PERFORMANCE CHARACTERISTICS—AN EXTREMELY HIGH THEORETICAL SHIFTING EQUILIBRIUM, A TOTAL MOTOR BURNING TIME OF 18 MINUTES AT HIGH PERCENTAGES OF THEORETICAL SPECIFIC IMPULSE. SUPERIOR DESIGN PROVIDES MOTORS THAT ARE SIMPLE, RELIABLE, LIGHT WEIGHT—IDEAL FOR UPPER STAGE APPLICATIONS. THESE ROCKET ENGINEER SIXTY-OF-THE-ART AT UTC.



United Technology Corporation

P. O. Box 555 Sunnyvale, California

Subsidiary of UNITED TECHNOLOGY CORPORATION
U
A



CALCULATED SOUND SATs for a specific heavy waste test conducted Dec. 20, 1960. Test produced a high noise level at Hanford.

the rocket engine goes up, the peak frequency goes down.

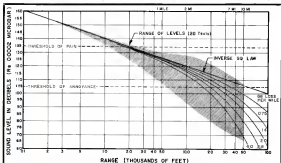
This affects the sound level at long ranges because the lower frequencies do not attenuate as rapidly, thus a larger percentage of the original sound energy is left to disturb nearby areas. Also, as the energy peak drops in frequency, additional energy is put into the vulnerable range. Since it is there

lower frequencies which rattle windows and shake buildings, the "alarm level" is expected to rise with larger booms. Another factor affecting the amount of acoustic energy which reaches the surrounding area is what is known as the "directivity" of the source.

This is simply an index of the relative amounts of energy which are directed by the source itself in each direction.

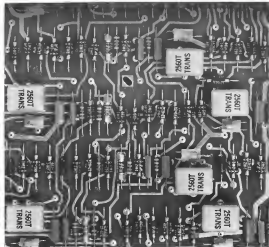
Contributing to this are not only the rocket engine and exhaust velocity parameters but also the shape and construction of the flame deflector and test stand. After the sound has been released into the atmosphere, several things can happen.

• The sound can be propagated upwards as in a still room or large stadium where the effects of wind and temperature



VARIATION OF OVERALL SOUND LEVEL with range at dawn. Threshold of annoyance value is based on experience with Saturn testing.

AVIATION WEEK and SPACE TECHNOLOGY, November 2, 1962



As complexity grows, so must individual component reliability

This is a tiny portion of the miles of complex Bell Telephone circuits used for military and civilian communications.

In order for each circuit to work properly, every component in the circuit must function according to design standards.

As circuit complexity increases, an almost incredibly high reliability must be engineered into each component.

It is, in the Bell System.

Bell System communications specialists have

extended component reliability to new heights of achievement.

In addition, every major communications channel gains support from the vast network that is in being, so that if one channel fails, a "make good" channel maintains continuity.

Communications are the lifelines of our defense system. Nothing is left to chance in the Bell System to assure that these lifelines will always function.



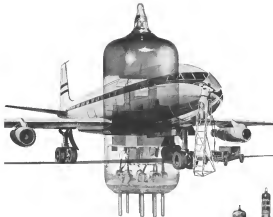
Bell Telephone System

AMERICAN TEL. & TEL. CO. / WESTERN ELECTRIC CO. / BELL TELEPHONE LABORATORIES / BELL OPERATING COMPANIES

Space Vehicle Log

(As of Oct. 20)

1962 Satellite in Orbit	Name	Source	Launch Date	Instruments (kg)	Period (min)	Apogee (mi)	Perigee (mi)	Transmitting Power (mW)	Weight in Orbit (lb.)
Explorer 1	Explorer 1	USAF	Jan. 24	10,000	90.4	1,000	6,000	100	130
Explorer 2	Explorer 2	USAF	Feb. 16	10,000	90.4	1,000	6,000	100	130
Explorer 3	Explorer 3	USAF	Mar. 18	10,000	90.4	1,000	6,000	100	130
Explorer 4	Explorer 4	USAF	Apr. 24	10,000	90.4	1,000	6,000	100	130
Explorer 5	Explorer 5	USAF	May 28	10,000	90.4	1,000	6,000	100	130
Explorer 6	Explorer 6	USAF	Jun. 14	10,000	90.4	1,000	6,000	100	130
Explorer 7	Explorer 7	USAF	Jul. 16	10,000	90.4	1,000	6,000	100	130
Explorer 8	Explorer 8	USAF	Aug. 17	10,000	90.4	1,000	6,000	100	130
Explorer 9	Explorer 9	USAF	Sep. 18	10,000	90.4	1,000	6,000	100	130
Explorer 10	Explorer 10	USAF	Oct. 19	10,000	90.4	1,000	6,000	100	130
Explorer 11	Explorer 11	USAF	Nov. 20	10,000	90.4	1,000	6,000	100	130
Explorer 12	Explorer 12	USAF	Dec. 21	10,000	90.4	1,000	6,000	100	130
Explorer 13	Explorer 13	USAF	Jan. 22	10,000	90.4	1,000	6,000	100	130
Explorer 14	Explorer 14	USAF	Feb. 23	10,000	90.4	1,000	6,000	100	130
Explorer 15	Explorer 15	USAF	Mar. 24	10,000	90.4	1,000	6,000	100	130
Explorer 16	Explorer 16	USAF	Apr. 25	10,000	90.4	1,000	6,000	100	130
Explorer 17	Explorer 17	USAF	May 26	10,000	90.4	1,000	6,000	100	130
Explorer 18	Explorer 18	USAF	Jun. 27	10,000	90.4	1,000	6,000	100	130
Explorer 19	Explorer 19	USAF	Jul. 28	10,000	90.4	1,000	6,000	100	130
Explorer 20	Explorer 20	USAF	Aug. 29	10,000	90.4	1,000	6,000	100	130
Explorer 21	Explorer 21	USAF	Sep. 30	10,000	90.4	1,000	6,000	100	130
Explorer 22	Explorer 22	USAF	Oct. 31	10,000	90.4	1,000	6,000	100	130
Explorer 23	Explorer 23	USAF	Nov. 1	10,000	90.4	1,000	6,000	100	130
Explorer 24	Explorer 24	USAF	Dec. 2	10,000	90.4	1,000	6,000	100	130
Explorer 25	Explorer 25	USAF	Jan. 3	10,000	90.4	1,000	6,000	100	130
Explorer 26	Explorer 26	USAF	Feb. 4	10,000	90.4	1,000	6,000	100	130
Explorer 27	Explorer 27	USAF	Mar. 5	10,000	90.4	1,000	6,000	100	130
Explorer 28	Explorer 28	USAF	Apr. 6	10,000	90.4	1,000	6,000	100	130
Explorer 29	Explorer 29	USAF	May 7	10,000	90.4	1,000	6,000	100	130
Explorer 30	Explorer 30	USAF	Jun. 8	10,000	90.4	1,000	6,000	100	130
Explorer 31	Explorer 31	USAF	Jul. 9	10,000	90.4	1,000	6,000	100	130
Explorer 32	Explorer 32	USAF	Aug. 10	10,000	90.4	1,000	6,000	100	130
Explorer 33	Explorer 33	USAF	Sep. 11	10,000	90.4	1,000	6,000	100	130
Explorer 34	Explorer 34	USAF	Oct. 12	10,000	90.4	1,000	6,000	100	130
Explorer 35	Explorer 35	USAF	Nov. 13	10,000	90.4	1,000	6,000	100	130
Explorer 36	Explorer 36	USAF	Dec. 14	10,000	90.4	1,000	6,000	100	130
Explorer 37	Explorer 37	USAF	Jan. 15	10,000	90.4	1,000	6,000	100	130
Explorer 38	Explorer 38	USAF	Feb. 16	10,000	90.4	1,000	6,000	100	130
Explorer 39	Explorer 39	USAF	Mar. 17	10,000	90.4	1,000	6,000	100	130
Explorer 40	Explorer 40	USAF	Apr. 18	10,000	90.4	1,000	6,000	100	130
Explorer 41	Explorer 41	USAF	May 19	10,000	90.4	1,000	6,000	100	130
Explorer 42	Explorer 42	USAF	Jun. 20	10,000	90.4	1,000	6,000	100	130
Explorer 43	Explorer 43	USAF	Jul. 21	10,000	90.4	1,000	6,000	100	130
Explorer 44	Explorer 44	USAF	Aug. 22	10,000	90.4	1,000	6,000	100	130
Explorer 45	Explorer 45	USAF	Sep. 23	10,000	90.4	1,000	6,000	100	130
Explorer 46	Explorer 46	USAF	Oct. 24	10,000	90.4	1,000	6,000	100	130
Explorer 47	Explorer 47	USAF	Nov. 25	10,000	90.4	1,000	6,000	100	130
Explorer 48	Explorer 48	USAF	Dec. 26	10,000	90.4	1,000	6,000	100	130
Explorer 49	Explorer 49	USAF	Jan. 27	10,000	90.4	1,000	6,000	100	130
Explorer 50	Explorer 50	USAF	Feb. 28	10,000	90.4	1,000	6,000	100	130
Explorer 51	Explorer 51	USAF	Mar. 1	10,000	90.4	1,000	6,000	100	130
Explorer 52	Explorer 52	USAF	Mar. 2	10,000	90.4	1,000	6,000	100	130
Explorer 53	Explorer 53	USAF	Mar. 3	10,000	90.4	1,000	6,000	100	130
Explorer 54	Explorer 54	USAF	Mar. 4	10,000	90.4	1,000	6,000	100	130
Explorer 55	Explorer 55	USAF	Mar. 5	10,000	90.4	1,000	6,000	100	130
Explorer 56	Explorer 56	USAF	Mar. 6	10,000	90.4	1,000	6,000	100	130
Explorer 57	Explorer 57	USAF	Mar. 7	10,000	90.4	1,000	6,000	100	130
Explorer 58	Explorer 58	USAF	Mar. 8	10,000	90.4	1,000	6,000	100	130
Explorer 59	Explorer 59	USAF	Mar. 9	10,000	90.4	1,000	6,000	100	130
Explorer 60	Explorer 60	USAF	Mar. 10	10,000	90.4	1,000	6,000	100	130
Explorer 61	Explorer 61	USAF	Mar. 11	10,000	90.4	1,000	6,000	100	130
Explorer 62	Explorer 62	USAF	Mar. 12	10,000	90.4	1,000	6,000	100	130
Explorer 63	Explorer 63	USAF	Mar. 13	10,000	90.4	1,000	6,000	100	130
Explorer 64	Explorer 64	USAF	Mar. 14	10,000	90.4	1,000	6,000	100	130
Explorer 65	Explorer 65	USAF	Mar. 15	10,000	90.4	1,000	6,000	100	130
Explorer 66	Explorer 66	USAF	Mar. 16	10,000	90.4	1,000	6,000	100	130
Explorer 67	Explorer 67	USAF	Mar. 17	10,000	90.4	1,000	6,000	100	130
Explorer 68	Explorer 68	USAF	Mar. 18	10,000	90.4	1,000	6,000	100	130
Explorer 69	Explorer 69	USAF	Mar. 19	10,000	90.4	1,000	6,000	100	130
Explorer 70	Explorer 70	USAF	Mar. 20	10,000	90.4	1,000	6,000	100	130
Explorer 71	Explorer 71	USAF	Mar. 21	10,000	90.4	1,000	6,000	100	130
Explorer 72	Explorer 72	USAF	Mar. 22	10,000	90.4	1,000	6,000	100	130
Explorer 73	Explorer 73	USAF	Mar. 23	10,000	90.4	1,000	6,000	100	130
Explorer 74	Explorer 74	USAF	Mar. 24	10,000	90.4	1,000	6,000	100	130
Explorer 75	Explorer 75	USAF	Mar. 25	10,000	90.4	1,000	6,000	100	130
Explorer 76	Explorer 76	USAF	Mar. 26	10,000	90.4	1,000	6,000	100	130
Explorer 77	Explorer 77	USAF	Mar. 27	10,000	90.4	1,000	6,000	100	130
Explorer 78	Explorer 78	USAF	Mar. 28	10,000	90.4	1,000	6,000	100	130
Explorer 79	Explorer 79	USAF	Mar. 29	10,000	90.4	1,000	6,000	100	130
Explorer 80	Explorer 80	USAF	Mar. 30	10,000	90.4	1,000	6,000	100	130
Explorer 81	Explorer 81	USAF	Mar. 31	10,000	90.4	1,000	6,000	100	130
Explorer 82	Explorer 82	USAF	Apr. 1	10,000	90.4	1,000	6,000	100	130
Explorer 83	Explorer 83	USAF	Apr. 2	10,000	90.4	1,000	6,000	100	130
Explorer 84	Explorer 84	USAF	Apr. 3	10,000	90.4	1,000	6,000	100	130
Explorer 85	Explorer 85	USAF	Apr. 4	10,000	90.4	1,000	6,000	100	130
Explorer 86	Explorer 86	USAF	Apr. 5	10,000	90.4	1,000	6,000	100	130
Explorer 87	Explorer 87	USAF	Apr. 6	10,000	90.4	1,000	6,000	100	130
Explorer 88	Explorer 88	USAF	Apr. 7	10,000	90.4	1,000	6,000	100	130
Explorer 89	Explorer 89	USAF	Apr. 8	10,000	90.4	1,000	6,000	100	130
Explorer 90	Explorer 90	USAF	Apr. 9	10,000	90.4	1,000	6,000	100	130
Explorer 91	Explorer 91	USAF	Apr. 10	10,000	90.4	1,000	6,000	100	130
Explorer 92	Explorer 92	USAF	Apr. 11	10,000	90.4	1,000	6,000	100	130
Explorer 93	Explorer 93	USAF	Apr. 12	10,000	90.4	1,000	6,000	100	130
Explorer 94	Explorer 94	USAF	Apr. 13	10,000	90.4	1,000	6,000	100	130
Explorer 95	Explorer 95	USAF	Apr. 14	10,000	90.4	1,000	6,000	100	130
Explorer 96	Explorer 96	USAF	Apr. 15	10,000	90.4	1,000	6,000	100	130
Explorer 97	Explorer 97	USAF	Apr. 16	10,000	90.4	1,000	6,000	100	130
Explorer 98	Explorer 98	USAF	Apr. 17	10,000	90.4	1,000	6,000	100	130
Explorer 99	Explorer 99	USAF	Apr. 18	10,000	90.4	1,000	6,000	100	130
Explorer 100	Explorer 100	USAF	Apr. 19	10,000	90.4	1,000	6,000	100	130
Explorer 101	Explorer 101	USAF	Apr. 20	10,000	90.4	1,000	6,000	100	130
Explorer 102	Explorer 102	USAF	Apr. 21	10,000	90.4	1,000	6,000	100	130
Explorer 103	Explorer 103	USAF	Apr. 22	10,000	90.4	1,000	6,000	100	130
Explorer 104	Explorer 104	USAF	Apr. 23	10,000	90.4	1,000	6,000	100	130
Explorer 105	Explorer 105	USAF	Apr. 24	10,000	90.4	1,000	6,000	100	130
Explorer 106	Explorer 106	USAF	Apr. 25	10,000	90.4	1,000	6,000	100	130
Explorer 107	Explorer 107	USAF	Apr. 26	10,000	90.4	1,000	6,000	100	130
Explorer 108	Explorer 108	USAF	Apr. 27	10,000	90.4	1,000	6,000	100	130
Explorer 109	Explorer 109	USAF	Apr. 28	10,000	90.4	1,000	6,000	100	130
Explorer 110	Explorer 110	USAF	Apr. 29	10,000	90.4	1,000	6,000	100	130
Explorer 111	Explorer 111	USAF	Apr. 30	10,000	90.4	1,000	6,000	100	130
Explorer 112	Explorer 112	USAF	May 1	10,000	90.4	1,000	6,000	100	130
Explorer 113	Explorer 113	USAF	May 2	10,000	90.4	1,000	6,000	100	130
Explorer 114	Explorer 114	USAF	May 3	10,000	90.4	1,000	6,000	100	130
Explorer 115	Explorer 115	USAF	May 4	10,000	90.4	1,000	6,000	100	130
Explorer 116	Explorer 116	USAF	May 5	10,000	90.4	1,000	6,000	100	130
Explorer 117	Explorer 117	USAF	May 6	10,000	90.4	1,000	6,000	100	130
Explorer 118	Explorer 118	USAF	May 7	10,000	90.4	1,000	6,000	100	130
Explorer 119	Explorer 119	USAF	May 8	10,000	90.4	1,000	6,000	100	130
Explorer 120	Explorer 120	USAF	May 9	10,000	90.4	1,000	6,000	100	130
Explorer 121	Explorer 121	USAF	May 10	10,000	90.4	1,000	6,000	100	130
Explorer 122	Explorer 122	USAF	May 11	10,000	90.4	1,000	6,000	100	130
Explorer 123	Explorer 123	USAF	May 12	10,000	90.4	1,000	6,000	100	130
Explorer 124	Explorer 124	USAF	May 13	10,000	90.4	1,000	6,000	100	130
Explorer 125	Explorer 125	USAF	May 14	10,000	90.4	1,000	6,000	100	130
Explorer 126	Explorer 126	USAF	May 15	10,000	90.4	1,000	6,000	100	130
Explorer 127	Explorer 127	USAF	May 16	10,000	90.4	1,000	6,000	100	130
Explorer 128	Explorer 128	USAF	May 17	10,000	90.4	1,000	6,000	100	130
Explorer 129	Explorer 129	USAF	May 18	10,000	90.4	1,000	6,000	100	130
Explorer 130	Explorer 130	USAF	May 19	10,000					



How to enhance reliability of critical avionics equipment!

A good equipment design, proven under laboratory conditions, may sometimes perform atrociously during field life. Why? Consider the type of components used. Are they field proven? Do they offer documented reliability?

Take the case for electronic vacuum tubes. Tests by ARLC Research Corp.* document the dramatic improvements in tube reliability since 1954. The results of tests conducted aboard naval vessels, for example, show a condensed tube removal rate of 1.9% per 1000 hours in 1954. By 1960 this figure dropped to 1.2% for miniature tubes and a remarkable 0.19% for subminiature tubes. All the condensed tube subminiature types in this test were Sylvania tubes.**

Electronic tubes are virtually unaffected by stresses in environments. Examples: Sylvania G8 Gold Grids. Sylvania, specifically designed for aerospace-commercial aviation, man-

ufactured performance drops after shocks of 500g, fatigue tests at 2.5g for 96 hours, high-temperature of 165°C. They are unrivaled in electrical stability, uniformity and ease of interchangeability.

If avionics equipment reliability concerns you, be specific about the components you use. Make sure they are superior-quality electronic tubes—look for the Sylvania G8 Gold Grid markings on the tubes. A complete list of G8 Gold Grid types, and, gratifyingly, is yours for the writing. Electronic Tubes Division, Sylvania Electric Products Inc., 1300 Main St., Buffalo 2, N. Y.

*George ARLC Research Corp., is published in publication #914-38-587 (PUB 38-587).

**Take your present or next tube on the testing. Give it the same treatment Sylvania's tubes undergo. You'll find the same results. Sylvania's tubes are unrivaled in electrical stability, uniformity and ease of interchangeability.

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SYLVANIA

GENERAL TELEPHONE & ELECTRONICS

NASA Contracts

National Aeronautics and Space Administration recently awarded the following contracts and research grants:

RESEARCH CENTER, WASHINGTON, D. C.
Science Fair, Hamilton, Calif.—\$100,000 for research-oriented experiments for production in regard to scientific design of space vehicles.

Naval Research Corp., Baltimore 33—\$10,000 for development studies of control in physical control.

Isaiah Research Institute, Santa Fe, N.M.—\$10,000 for studies and development of advanced research in the field of micro-encapsulated tubes and methods of tube life tests for improved to improve weather meter systems.

Isaiah Research Institute, Santa Fe, N.M.—\$10,000 for development of reduced problems associated with micro-encapsulated tubes.

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Soviet Vostok Report

Minor-Soviet Russia announced that Vostok 1 and 4 were launched into the same orbit at 100 miles within 24 hr., and that within days there the closest two manned spacecraft race in each other at 4,600 mi.

Thus the highlights of a highly report is a recent issue of *Parade* on the Soviet-American group flight of Soyuz-Aurora and La Col. Fred Popovick in *Parade* (Aug. 28, p. 26, Aug. 27, p. 36). The article said that Vostok 1 and 4 were launched at a total of 5.5 hr., and that Popovick found about 5 hr.

The two Soviet flights reported in a news conference Aug. 24, for days after they landed, that they were not designed to perfect underwater techniques, and they met at that time that they could approach was 5.5 hr.



Taber Transducers monitor pressures in new space vehicle system at Bell

Measuring gas pressures in propellant feed lines and a rocket throat chamber, Taber TELE-NEWS provides transducers as a vital part of a new pressure-measuring system developed by Taber's Bell Aerospace Company. The system controls continuous work aspect to earth for vehicles in outer space.

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Explorations

The magic world of adventure—the key to man's advance in every field of endeavour. The statue of Champlain holding high his astrolabe to the Parliament Buildings in Ottawa, commemorates the very "Bark of Exploration"—paving the way into the unknown and broadening man's horizons. Such is the task of Computing Devices of Canada Limited—opening new frontiers in the development of airborne integrated navigation systems and displays, photographic systems, advanced electronic instrumentation, aerophysics and space research—in fact, exploration and discovery in the broad spectrum of science in the service of man.

The ASTROLABE, an early aircraft-mounted computing device, played an important role in SAMUEL DE CHAMPLAIN's explorations in the New World. His ASTROLABE, lost in 1612, was found near Ottawa in 1937—the first Canada becomes a nation.

Computing Devices
OF CANADA LIMITED
P.O. BOX 508, OTTAWA 4, CANADA
AN AFFILIATE OF THE BENDIS CORPORATION

C-103

use displays in this. This provides a signal which is amplified and applied to a motor device which controls a drag cup which applies a torque to rotate the arm to its original position. The number of rotations made by the display motor is a good statement of time to rotate the arm to neutral position is proportional to the first integral of vehicle acceleration, or its velocity. A thermally-stabilized electric heater is provided to maintain a steady-state constant temperature, since the magnetic drag of the cup on the arm otherwise would vary with temperature and change stationary calibration.

Computer Functions

However, Koen explains that the electric power is applied only during pre-launch and launch conditions and is not needed during dipping or post-launch landing.

Manitowac's multi-bore digital computer performs a number of functions. Working from vehicle attitude and velocity signals obtained from gyro and accelerometers, it solves the basic guidance-to-target equations, generates air-to-surface steering commands and also solves flight control equations which take into account the aerodynamic characteristics of the vehicle.

Additionally, the computer controls staging and thrust termination for each of the three stages and determines when it is safe to jettison the upper stage. At the end of the third stage, the engine functions have been performed by a separate computer. In the idle, the main computer is used for the continuous course checkout of the overall mode and periodically to perform detailed performance and calibration tests. It also serves to coordinate the missile prior to launch.

Computing occupies about one-half of the outer shell of the guidance system structure, whose diameter is 65 in., while the other half contains the servo amplifiers and controls for the gyro stabilized platform. The platform itself is housed in the centre of the structure, which has an inner diameter of 32 in.

Computing is a general purpose solid machine using a 25-bit word length, at which 24 bits are used for computation. The machine operates at a clock rate of 345.6 kc, which provides addition time at about 75 microseconds and multiplication time of about one microsecond.

Computer memory unit is a rotating magnetic disk, operating at 6,000 rpm, which is supported radially through a thin, metal diaphragm by a bell-shaped bearing ring, according to Dr. W. L. Mead, project engineer. The memory unit used in the first Manitowac wing has a capacity of 2,565 words.

Computer supplies three pairs of digital outputs which are used to control



INTERCONNECTION of solidified copper and platinum amplifiers, mounted on ceramic shells, requires thousands of solidified joints. Operation is performed in a special fixture which allows shells to be easily seated for opposite arms.

external equipment such as gyro and three engine voltage output which serve to command movement of the motor to provide pitch, roll and yaw control. Additionally, the computer is designed to supply an output for operating a paper tape punch in electric typewriter for printing out results of check-out tests, and another for generating telemetry data.

External Equipment

Computer also accepts 11 analog type inputs from external equipment. For example, an input from one of the gyros indicating that it is malfunctioning will block the computer from using the accuracy command to aim the weapon.

Computer has two basic computation cycles. One is used to solve the basic guidance equation—what is the angle of the rocket with respect to where it should be to hit its intended target. The other, performed at more frequent intervals, is used to generate steering signals for the flight control system.

Azimuth is derived from the conventional practice of using a separate set of gyros in the booms to provide vehicle attitude signals for flight control purposes. Spatially, it acts two angles accelerometer mounted in the second stage for the initial portion of the pre-launch flight.

When the second stage is dropped, the stabilized platform takes over as the attitude reference.

One reason for using accelerometers is that they are less complex than gyros. Another is that they provide no direct drift, which is needed for satisfactory vehicle guidance. Stabilized platform can not be used as a flight control reference for the first two stages, except in the roll axis. The reason is that descent and banking of

the missile during early stages of flight would produce cross-axis pitch and yaw attitude deviations at the stabil platform location.

Once the first and second stages have been dropped, the remaining portion of the vehicle is sufficiently rigid to permit the platform to serve as an attitude reference for the remainder of the guided part of the flight.

Automatic guidance and control system requires about 15,000 components. Of this total, about 15,800 are in the guidance package and 7,000 are in the three engine motor control units. Of the 15,000 in the guidance package, about 15,000 are in the computer, while the remainder functions with the stable platform.

Manitowac engineers are designed so that it can be completely reprogrammed, if desired, by changing the information stored in the magnetic disk memory. After the missile is in the air, a track-mounted programmer is moved up to insert specific data on the missile's assigned target location.

Automatic attitude point out that with Manitowac, it is not necessary to supply the guidance instructions for each missile to compensate for the characteristics of the particular aircraft and gyro installed in the missile, an added complexity required for most other ICBMs.

Complete guidance package, consisting of solidified platform, associated sensors and the computer is housed in a solid gold-plated container filled with helium. Electric power for the guidance package is supplied by a battery, supplying energy in a slot along around the lower portion of the base.

Helium Contain

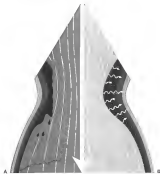
To provide cooling for the sensitive equipment, the helium contains a filter with helium. It also contains a circulating fan and a liquid type heat exchanger in its base. While the missile is in the air, liquid coolant is pumped into the heat exchanger and is allowed to be in contact of the circulating helium gas. At launch, the coolant is dumped, and the guidance package and associated sensors are cooled by the helium gas. The coolant is then changed, increasing its temperature rate which remains within allowable limits for the duration of the guidance function.

Basic guidance package is enclosed with data files and placed in a specially oriented aluminum microprocessor enclosure built in North America's Space and Information Systems Division.

The complete package is then shipped by missile onto the third stage by Boeing.

Several major component and subsystem improvements were introduced into the guidance and control system

AEROPHYSICS



New knowledge of fluid dynamics and heat transfer gradually is forcing a revision in our thinking about solid rocket nozzle coating problems. For example, we now know that use of the "two metal" principle in the design of nozzles permits us to expose metals to temperatures well above their normal boiling points. In the two metal system, one metal is allowed to boil within another. As boiling occurs, the boiling products of the first metal pass through the pores of the second, thus cooling it by convection, mass transfer, and heat absorption in the phase changes. The above drawings show how hot gases passing through a nozzle (A) erode "pure" metal such as tungsten at the throat. In (B), mass-transfer cooling protects the metal from erosion. This and other coating techniques permit our design engineers to overcome inherent limitations of materials now available for nozzle applications.

We invite you to participate in our challenging advanced research activities. Aerojet-General® needs scientists with advanced degrees and unusually high levels of achievement in materials technology: physics, chemistry, mathematics, fluid mechanics, and heat transfer. Your letter will receive prompt confidential attention. Write Dr. P. L. Nichols, Jr., Manager, Aerojet General Solid Rocket Research, P. O. Box 1947-J, Azusa, California. An equal opportunity employer.



SOLID ROCKET PLANT / Azusa, California

production for Wing 1. A more significant design improvement is planned for introduction with a later wing. Their design, intended to reduce system weight and improve reliability are:

- **Microswitches:** currently, using discrete micro-components and linked-on switches with complex (point) circuit solenoids, will be substituted for present conventional circuitry in construction events (AW May 14, p. 95).

- **New event design:** employs interstage coupling techniques intended to increase the use of expansion. This also has a long-range objective of saving the way to use of semiconductor micro-circuits at a later date. Such micro-circuits does not lend itself to fabrication of large coupling assemblies.

- **New switching transition:** will be used to provide a means to minimize the number of power transistors needed.

Beyond the proposed Minuteman design, Aerojet is doing performance work on what is termed the "Advanced Minuteman," although production is expected to be several years away. For this design, Aerojet aims to finish almost completely a semiconductor micro-circuit, at least for low power circuits. Its studies indicate that 17 basic types of events can handle the bulk of the circuit needs, Aerojet West has told.

Aerojet has surveyed about a dozen new conductors, micro-circuits, fasteners and plans to select a few to provide simple quantities for expansion and extensive performance and life tests.

(This is the concluding article in a two-part series. The first article appeared in *Aerojet West*, Oct. 28, p. 17).



Thermionic Generator

Converts abundant thorium-based gamma fission 23 with all effects of 7.5%, which is expected to be 16-12% in expanded design. Thermionic generator (shown in brief, made by Thermo Electron Engineering Corp., operates at less than 1,000°C).

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"SUPER-INSULATED" CRYOGENIC VESSELS



Liquid hydrogen loss less than 1% per day!

This 5000 gal. dewar tank, insulated by STANDARD SMC-2 "Super-Insulation" now proven designed for Federal Electric position. Used in a liquid hydrogen flow system for an advanced space-flight project, it holds hydrogen over time in less than 1% per day. Weighing up to 11,815 lbs. by volume, this revolutionary STANDARD SMC-2 can hold evaporative losses to considerably less than 1% when tested.

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PROBLEMATIC RECREATIONS 143



Three bars are standing in a triangular field which is exactly 100 yards on each side. One bar stands in each corner, and antidiagonally of these set off reason. Each bar must also be the base in the opposite corner on his left, thus following a curved course which involves in the middle of the field, all three bars among these together. The bars obviously run at the same speed, but just how far did they rise? —Continued

Length: 13 inches Diameter: 1/2 of an inch Weight: 32 grams Noise: 10-1700 Hz's new high gain, broadband CW tracking wave amplifier from our San Carlos group. The combination-cooled TWT provides a minimum CW power output of one watt with 40 db minimum until signal gain over the frequency range, 5,000-10,000 Mc, and two watts CW with 40 db minimum until signal gain, over the 7,000-10,000 Mc range. Learn more from the Marketing Department, Division Sales Division, 900 Industrial Rd., San Carlos.

ANSWER TO LAST WEEK'S PUZZLE: $10011 + 2, 10011 + 3, \dots, 10011 + 1001, 1011 + A$ is divisible by A as long as $A > 1$ and $C \leq 10$.

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Decision-Making: Hostile or not Hostile?

A few years ago, the decision was relatively simple. Today, the consequences of this type of decision-making can be enormous, affecting world-wide forces and events. The decision itself may trigger an incredibly complex series of interacting decisions and controls. In making these compressed-time decisions, commanders use man-machine systems which provide information processing assistance. The development of these large systems is the work of scientists, engineers and computer programmers at System Development Corporation.

operation. The system is their concept, not the actual design of hardware. Specifically, they coordinate the key elements defining the requirements of the system, synthesizing the system, interacting the computers within the system, making the system, evaluating the system. Throughout they seek to optimize man-computer relationships and to develop a system which grows and changes with the needs of the decision-makers who use it. Human factors scientists, operations research specialists, systems-oriented engineers and computer programmers interested in joining a

close interdisciplinary effort are invited to write concerning new positions in this expanding field. Address Dr. H. C. Ross, SDC, 3402 Colorado Ave., Santa Monica, California. Persons are open at SDC facilities in Santa Monica, Washington, D.C., Berkeley, Massachusetts, Panama, New Jersey and Dayton, Ohio. "An equal opportunity employer."

SDC
System Development Corporation

System that helps men make decisions and control complex



11-007

NEW AVIONIC PRODUCTS

• **Low-cost control computers**, can quickly add state, stored program digital type which will fit approximately 150,000, but a basic module of 2,845 words.



24 bits in length including sign. Add subtract time is 75 nanoseconds. Computer is designed for actual environment and does not require an emulated machine, according to the manufacturer. Electronic Computer Corp., Dept. DM-4, 2515 E. Franklin Ave., Minneapolis 6, Minn.



• **Silicon micro-modules**, with front to back mounting, ratio greater than 10 better to use with microelectronics greater than 400 mils at 1 volt, and with peak reverse voltage range of 1,000 v. Strad cell melt dissipate 100 mw, while silicon can handle 150 mw or more. Units are designed to meet MIL-S-99500 and operate above 150°C temperature; the manufacturer reports. Micro Semiconductor Corp., 11150 Plaza Court, Culver City, Calif.

• **Digital logic modules**, called Digicore, new line of 22 circuits allow use of AND/OR or NOR logic directly either in discrete or microelectronics format. Basic logic functions are in use. Digicore modules are available in handle form up to 15 and loads. Frequency range is 0 to 100 kc with clock rate to 200 kc. All logic circuit depends on average approximately 0.6 v 0.6 v 0.6 v

in and out ported in space. Sanders Associates, Inc., 85 Canal St., Nashua, N.H.

• **Two-way state gate**, Type G-14, has gate rates which is centered in state rate rate to two pairs of independent positioned jobs. Movement of gate rate causes change of focus in code which is caused by piezoelectric can induce to provide output signal. A composite two-way voltage which is modified in a superband amplifier and two demodulators. Design is adaptable for rate variations ranging from 0.02 to 1,000 deg. per second. Core measures 2 in. dia. x 4 in. long. Weight about 24 lb. Avnetics Corp., 1000 Ave. Corp., Garden City, L. I., N. Y.



1 x 4 x 4 in. Device can operate continuously at ambient temperature of 55°C, without 100% modification and impact, according to manufacturer, Electronic Computer Corp., Box 12246, St. Petersburg 13, Fla.



• **Trouble-shoot thermal**, independent type, for use in temperature heater or sensor, single unit 0.4 g. and responds five times faster than comparable unit, manufacturer says. Device is available either with threaded plug or pin terminals, rated up to 5 mg at 115 v a.c. or 30 v d.c. with temperature rating range of 0 to 350°F. Technical bulletin DD PRET 12 gives application data. Metal & Controls Inc., 14 Forest St., Attleboro, Mass.

NOW!
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See Dealer That Sells Your Arms or this equipment, Page 70

The SMART System, Multifunction Analysis, Requirement, Training incorporates the advantages of programmed learning with the competence and flexibility of self-paced computer checks. It will save many thousands of weapon systems.

The SMART System:

- Reduces the high rate of training time to useful service life.
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- Reduces a complex system to its basic logic for rapid learning.
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- Can simulate any problem that can be presented by schematic logic.

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HOURS between routine maintenance checks has been recommended to field users of the CRYODYNE. Several CRYODYNE systems have operated for longer periods without checkups.

HOURS with the people at Division 800 will show you how ADL CRYODYNE Refrigerators can be applied to the cooling of lasers, superconductive circuitry, and superconducting magnets from 2.5 to 4°K. This means one save you time (and money) in your long-term development plans. And, our initial meeting with you is part of our development costs, not yours.

CRYODYNE TECHNICAL BRIEFS ■ **MODEL 100** — Helium bath refrigerator for superconductive circuitry 0.30 watts at 3.4°K. (Ask for Bulletin CRVE 117R) ■ **MODEL 110** — Helium bath refrigerator for superconductive circuitry and magnets 1.0 watt at 3.4°K. (Ask for Bulletin CRYK 398R) ■ **MODEL 200** — Helium refrigerator. Operation in any orientation. 0.9 watts at 4°K. (Ask for Bulletin CRER 332R)



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TRISTE FILTER CENTER GALLS

► **Processed Diode** Developed—New type diode, more junctions made of different types of semiconductors (hetero-junctions) may provide switching speeds of a few picoseconds (trillionths of a second) according to news item at the International Defense Materials Research Center who developed it. The new type diode also may be suitable for use as a highly efficient microwave detector at frequencies above 100 gr. (line). The new device has two diode, consisting of an N-type germanium junction grown on an N-type gallium arsenide junction, has a theoretical recovery time of about one picosecond, but this has not yet been confirmed by measurement for test of suitable test equipment. (RMI says. Device was developed by Dr. F. P. Fung and Dr. W. E. Howard at the Electron Devices Meeting in Washington)

► **Diode Isolated Transistor Source**—New refinements on the basic concept of isolated collectors coated by gallium arsenide diodes, first discovered by Lincoln Laboratories, was reported by IBM researchers at the Electron Devices Meeting. IBM experiments indicate that the common concept from the P-nor of the junction and results from recommendations involving an acceptor center.

► **Neglected Storage Cycle—Seeking explanation** for already discussed 75 month cycle in direction of solar winds in the equatorial atmosphere, which shift from east to west and back, at Five Cambridge Research Laboratories scientists have discovered a previously neglected 75-month storage period in addition to the well-known 11 year cycle. However, AFCS is not certain that there is a causal relationship between the two despite the apparent correlation since the 11-year cycle does not produce any predicted cycle effects on solar winds.

► **Lower Lasers—New output wave-lengths** for neodymium-doped glass lasers has been achieved by scientists at General Electric. Laser action has been obtained at 9,150 angstroms which effect focus among some external and outputs at 10,690 angstroms. Range threshold for the 9,150 angstrom laser is 700 joules at temperature of 53K. At outputs 50% above threshold, the stimulated emission spreads over a band of about 30 angstroms, centered at 9,150 angstroms. Program is sponsored by Office of Naval Research.

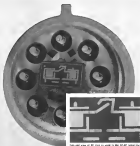
► **SuperPower Tubes Coating—East-McCallough** will develop an X-band

Ultrasonic capable of delivering one megawatt continuous (one-watt) power at 3 gr. (line). 10 times the power available today at this frequency according to the company. Research Development Center is sponsoring development under a 52.3 million contract.

► **Wideband Laser Modulator—Model** for laser, which has demonstrated a bandwidth of more than 1 gr. (line) and requires only 10 watts of power for operation has been developed by the Applied Research Laboratory, Alabama

Electric, a subsidiary of General Telephone & Electronics. Computer unit is expected to a 60 l increase in bandwidth and a 100 l reduction in power over previously demonstrated laser modulators. Device consists of two bias side with an electro-optic crystal material sandwiched between. Phase modulator is accomplished by laying voltage applied to crystal, with bias side serving as transmission line to apply voltage and to achieve the scale band operation. Modulator has been tested over frequency range from 10 to 100 megahertz (1 gr.)

Nanocircuit of the Month



Flip-Flop for Airborne Computers

Performance to 50 MC. Operable over the full MIL range from -55° to +125° C.

This is the next step in the evolution of nanocircuitry. General Instrument designed the concept of the switching network for maximum flexibility and performance. Now General Instrument offers the same performance with partial integration of the nanocircuit, resulting in a complete line of General Instrument Nanocircuitry is immediately available in a variety of package configurations. For more information, call your nearest sales office, General Instrument will be in touch with you. General Instrument Nanocircuitry is immediately available in a variety of package configurations. For more information, call your nearest sales office, General Instrument will be in touch with you.

GENERAL INSTRUMENT
SEMICONDUCTOR DIVISION
General Instrument Corporation

SOFTWARE

The hardware space (envi) is existing along slowly. The software for space travel to people, about which a great many issues are clear and some are not. Clear is man can survive a few hours out there. (Nikolayev, 1965) hours, no known after-effects.) To be determined: can a man survive in space for weeks, or months? (On a round-trip to the moon, for example. Or in an orbiting space station.)

The most visible and valuable component of any space system is man. His welfare out there is going to depend (in part) on the environment inside his vehicle. And the composition and pressure of that environment will depend on engineering requirements: weight, power, reliability. Suppose a pure oxygen, low-pressure environment were selected. How would our Automatic Function during a two-week mission?

NASA needs to know. They assigned us to find out. We're doing it right now.

The theory is simple enough. The procedure is not. It starts with our Environmental Test Chamber, airtight cylinder 39" x 39" in which we can

produce various combinations of temperature, pressure, humidity, radiation, and atmospheric composition. Inside, in groups of 6, go healthy young men in breathe pure oxygen for two weeks. For each group the pressure is changed. Pure oxygen at 5 psi for the first group, 7.6 psi for



the second and 3.8 psi for the third. A fourth group, breathing air at 14.7 psi, serves as control.

Outside the chamber are specialists in aerospace medicine, physiology, psychology, microbiology, biochemistry and environmental testing. During each two-week period that tests perform 600 specific tests on each man (heart, sensory, motor, pulmonary, hematological and neurological.) The group is monitored by instruments (calorimetry, and biograph) and the data fed continuously to a central and record each subject's reactions.

Probably the most significant oxygen pressure in the test program is 5 psi. That's the environment currently used for Project Mercury. It is also under consideration for Project Gemini, a planned two-week orbit for two Astronauts. Long before they go up, the "unknowns" of living in an oxygen environment will have become known. And the hazards thereof, if any, will have been planned down, studied and eliminated.

This research, supported by NASA, is being carried on at our Space Environment and Life Sciences Laboratory, to determine the effects of space travel upon the subjects as well as the hardware.

REPUBLIC
AVIATION CORPORATION



GRUMMAN A2F INTRUDER, all-weather strike and close support aircraft, is now in final phase of acceptance testing. Deliveries to Navy and Marine Corps units is expected to begin early next year, and Air Force also plans to purchase the plane in Fiscal Year 1964.

Extensive Electronics Aid A2F Capability

By C. M. Platter

Bethpage, N. Y.—Grumman A2F Intruder, all-weather strike and close support aircraft, met Navy's Oct. 4 Board of Inspection and Survey decision as suitable and fast delivery to Navy and Marine Corps units is expected early next year.

Board of Inspection and Survey at Patuxent River Naval Air Test Center, Md., which will maintain strength and weather are the first phase in acceptance by the Navy before aircraft are delivered to Replacement Air Groups (RAAGs).

Fiscal 1962 A2F acceptance for 34 aircraft was \$190.3 million. For Fiscal 1963, \$119.3 million was appropriated for 41 aircraft, and an additional \$56.2 million was slated for procurement of 17 A2F IAs (RAAGs).

New Department of Defense designation for the ECM version is EA-6A. The new AH-1 designation is A-6A.

The date 15 A2F-I have been built and flown by Grumman under what was originally described as Navy test requirements contract. Purchases and acceptance payments so far in the program have just about covered out going to Grumman production, but acceptance funding will not be completely developed until after acceptance trials.

An Electronics Counter Measures (ECM) version of the Intruder has also been ordered by Navy. Tested by company officials at the first growth version of the A2F, it will be undergoing development flights during the coming year. It is assumed that both versions

will possess ECM capabilities will be built into the aircraft.

STOL effect from tilting the tailplane of the plane's swept wing engines decreased 21 deg. during climb and landing built into early models will not be incorporated into production models. Navy has abandoned the idea, which reduced stall speed 6 kt, as an engine existed in view of the already slow 50 kt takeoff and landing speed. Tailplane in the production models will be angled downward 7 deg. from the roots as a compromise.

Extensive employment of electronic equipment is responsible for the A2F's unique day or night mission capability under all weather conditions. Marine Corps A2F aircraft will be primarily all-weather night close support for ground troops, using the aircraft's long endurance capabilities for loitering. Aircraft has short field landing and takeoff capability, as for Marine Corps requirements for a short line aircraft.

USAF Purchase Plans

Air Force has reported plans for purchase of A2F in its Fiscal 1964 budget as a result of Defense Dept. offer calling for full utilization of new aircraft in all services.

Continued interest in A2F development has been shown by Air Force but high initial cost and low takeoff speed have been major deterrents. Department of Defense officials would require the aircraft have takeoff rates in the 127 kt and later followed the program closely during Grumman's flight evaluations.

Carrier-based Navy A2Fs designed for close air support branch will also be used for close air support in addition to long-range, all-weather, all-weather strike missions, including nuclear weapons delivery.

In the low altitude, all-weather weapons delivery role the A2F can:

- Fly at speeds near Mach 3 close to the ground
- Fly at and below the target area, and release its bombs, all under control of the electronic flight control system.
- Pull up automatically to avoid enemy defense forces using terrain avoidance equipment. Terrain-following equipment is now being considered by Navy and can be installed at future models.
- Remain airborne for long periods of time, approaching targets during Douglas A2F times endurance being

Added, to fly at relatively high speeds at low altitude is intended to provide protection from ground fire and radar detection. Since the A2F is not a high speed aircraft, equipped with improved fighter jets of altitude, and can act as a machine gun or cannon, defense against enemy aircraft is presently limited to electronic means.

The electronic flight control system is a Digital Integrated Attack System (DIANS). It is basically a three-part system, consisting of sensors, computer and read-out displays.

Sensors, such as position and navigation radars, an inertial platform and pitot tube, require information on environmental conditions, position of the plane relative to the earth, fuel consumption and target information. Sensor outputs go to the computer which is

tion, pass the information to the pilot and bombardier/navigator on the rear seat scopes in the cockpit. The computer now in addition can command signals to the airborne flight control system to conform to a programmed flight envelope.

The screen also read information directly to a full complement of standard flight instruments, now referred to as standby flight instruments. Instruments being in the AIT will be done with reference only to a single integrated instrument display scope incorporating all necessary flight information.

Pilot's aid during an all-weather mission when the plane is controlled by the control computer and automatic flight control system, it makes one of making tactical decisions and controlling the flight according to Crampton. He can do any type, however, the control is fed into the computer different real-time information or instructions.

Present components of the Digital Integrated Attack System (see drawing circle).

• **Track radar, AN/APQ-88**, scope located in front of the aircraft and is capable of tracking or locking on moving targets. Airborne targets such as air-

side released from the aircraft or ground targets can be tracked depending on which mode is selected. Information is read out on the display by the pilot on a horizontal display scope located directly below the pilot's vertical display television scope, and by the bombardier/navigator on a separate scope located on his front console. Horizontal display is a view of the ground from above. Vertical display is a straight-ahead view of the horizon. Pilot and bombardier/navigator are side-by-side. Track radar is built by Naval Avionics Facility (NAVFAC) located at Indianapolis, Ind.

• **Search radar, AN/APQ-98**, built by Naval Laboratories division of United Aircraft, Norwalk, Conn., searches out moving targets and also scans horizon in front of aircraft. True-time evaluation radar operates in conjunction with the track radar, adding information on a time slot basis in front of the aircraft which is added to the virtual information display scope. Both pilot and bombardier/navigator are able to select multiple modes of track, search and terrain evaluation modes for cockpit control on a centrally located control panel.

• **AV data computer, CPM2A**, is a computer link, between environment sensing instruments and the central digital computer. It receives information on temperature and status and channels process, applies necessary instrument corrections and computer Mach number and pressure altitude. This information is fed directly into the central digital computer along with similar information from the Doppler radar. The AN/APN-41 is built by Litter Systems Inc. division of Litter Industries, Inc.

• **Doppler radar, AN/APN-41**, built by Ryan Electronics, is a multiple beam system used to obtain ground speed and wind information. The central digital computer can use ground speed and wind information from either or both the Doppler radar and the track radar.

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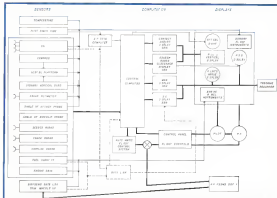
For detailed technical literature write: Raytheon Company, Dept. 88, 1415 Providence Turnpike, Norwood, Massachusetts.

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DIGITAL INTEGRATED ATTACK SYSTEM or AIAS is basically a three part system, composed of sensors, computers and read-out displays. Read-out displays for the pilot and the bombardier/navigator are located in the cockpit, and pilot can take control at any time.

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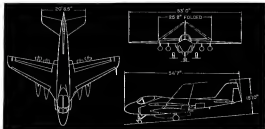
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Systems and Components (air)

Aircraft, Marine, Spacecraft, Electronic, Marine and Industrial Applications



THREE-VIEW SHOWS dimensions of the Grumman A1F-1 Jayhawk. It is a mid-wing, two-place aircraft with a single set of flight controls. Powerplants are two Pratt & Whitney JT3D-6 jet engines producing 3,500 lb thrust each at sea level.

nal platform, which provides redundant information.

Control digital computer, AN/AV-14, obtains information on the plane's position, altitude, fuel state, and altitude from the sensors. With this information on what the plane is doing it makes a comparison with the programmed flight sensor stored in its memory, and sends the information along with necessary correction information, to the cockpit display. If the plane is in automatic flight control mode, the computer sends correction commands to it to conform to programmed mission. The mechanical control computer also determines such things as ballistics of different weapons, correct position of bomb fuse, right type of ordnance has been dropped, and what weapons and fuel consumption. It can receive control of ordnance such as the fueling, guiding data on the way to programmed targets. This computer holds the central digital computer.

Automatic flight control system, AN/AV-14, can accomplish all basic air tasks necessary for the pilot except identify and landing. The system can automatically perform all conventional weapons delivery maneuvers with one of the weapons presently used in the Navy, including nuclear devices. Speed, Concepts, Co. handles the automatic flight control system.

In the cockpit, the pilot controls the program using the automatic flight control system as his aid, in all the conventional manner with a single set of flight controls. The headgear navigation system, on the right side, displays all of the pilot and can direct his seat to provide the pilot with better horizon visibility. Marine Corps and Navy are emphasizing the forward position in the A1F-1 mission, reconnaissance and provide the headgear navigation, and using some other equipment, a mapping and

target acquisition is essential to mission accomplishment. Based on two Pratt & Whitney JT3D-6 engines developing 3,500 lb thrust each at sea level, the A1F-1 has already demonstrated ability to deliver a 15,000 lb. bomb load. Naval interest grows weight will probably be 45,000 lb.

Terrain reference sights and fuel control information are also indicated on the vertical TV scope, which is built by Kinet Electronics Division of Kinet Industries Inc.

The AN/AV-14 horizontal outer scope is a prism to instrument for map-reading delivery. It is normally mounted to the pilot and operated by the headgear navigation system. A tracking recorder unit, consisting of a camera, reports scope and a camera records the entire mission procedure during flight. The filmed record of the mission can be used for training purposes or mission analysis evaluation.

The A1F-1 is a mid-wing, two-place aircraft with a single set of flight controls. The headgear navigation system, on the right side, displays all of the pilot and can direct his seat to provide the pilot with better horizon visibility. Marine Corps and Navy are emphasizing the forward position in the A1F-1 mission, reconnaissance and provide the headgear navigation, and using some other equipment, a mapping and

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Standard liquid oxygen systems (LON) and Martin Baker oxygen systems are used in the A2F. Airborne refueling will be possible with the public secured directly in front of the cockpit on top of the same section, angled upward and forward.

Minimum endurance with a full load of external fuel, including refueling, is over 5 hr.

The Strider is equipped with anti-skid brakes and large 30 in by 11 in tires on the main gear and dual 28 in by 5.5 in nose wheels. The aircraft has exceptional steering. Large tires were necessary for improved field capabil-



BAC 111 Fuselage Panel Machined From Aluminum

Fuselage side door panel for British Aircraft Corp.'s BAC 111 twin jet transport incorporates drainage and stiffeners adjacent to fuselage frames and extends to integral parts of the panel. Section was machined from solid light alloy aluminum 5083.

800 lb and maximum tension gross weight will be 55,000 lb.

With an external stanch, takeoff weight is 10,000 lb.

Loading edge, wing slots and wing tips are built individually attached to the door panels with movement of the flap handle, keeping the A2F's stiff panel doors in line in 90 in light configuration. A2F Program Manager Bruce Tottle told Avionics World, "Cross-sections of the loading pattern at 105,110 lb with gear and flap down, and report view, stable handling characteristics at these speeds."

Aerodynamic control about the roll axis is obtained with flap down on the top side of each wing adjacent to and forward of the flap. Control stick movement to the left raises left flap down meeting drag and a decrease in wing lift. The control drag up under the aircraft from the right wing thus tends to roll the aircraft to the left. Control surfaces about pitch and yaw, are a solid dash being tried and conventional roller control. Rollout surface has been increased by engine spin recovery characteristics by extending lower portion 16 in and top portion 2 in. Improved directional control on rollout has resulted.

Standard liquid oxygen system (LON) and Martin Baker oxygen systems are used in the A2F. Airborne refueling will be possible with the public secured directly in front of the cockpit on top of the same section, angled upward and forward.

Minimum endurance with a full load of external fuel, including refueling, is over 5 hr.

The Strider is equipped with anti-skid brakes and large 30 in by 11 in tires on the main gear and dual 28 in by 5.5 in nose wheels. The aircraft has exceptional steering. Large tires were necessary for improved field capabil-

ity and heavy maximum takeoff loads. Navy says the A2F will replace the Douglas propeller-driven AD aircraft currently being used for close air support and strike missions in an AD type aircraft in the fleet.

French Aircraft

First-French aviation industry officials are urging the French government to undertake development of three new aircraft to offset an anticipated slump in aircraft export sales during the mid-1960s.

Proposed projects include:

- Small Versatile Helicopter, a 32 passenger helicopter designed to fill the gap between the present Verso helicopter and the larger Conquest helicopter production. Helicopter powered in a power plant.
- Simplified version of the Dassault Mirage 3 fighter in order to countries with limited defense budgets. Planned version of the Mirage aircraft that was positioned to the first response Soviet MIG fighter aircraft in India.
- Small, two turbine transport powered with turbofans between engines.

All three aircraft are being prepared for 1964 submission by the National Committee for Expansion of the Aircraft Industry.

French aircraft export and service revenues in 1961 totaled approximately \$385 million and have already passed the \$120 million mark this year. Export aircraft next year are expected to total at about the \$200-million level, but are expected to decline to \$140 million in 1964 and to \$200 million in 1965.

After 1965 the high-French export aircraft and the Dassault Mirage fighters are expected to cause the decline of French exports in one year.



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GENERAL PRECISION

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Soviets Modify MiG-19 Fighter

[illegible]

some transport could be held off until 1992 in order to give airline operators an opportunity to work off their current fleets of outdated planes.

to be long-term engines planted for urban expansion in the coming decades will be land around major transportation. W. R. Collins of General Electric Co.'s Flight Propulsion Laboratory, said:

The predicted flow specific impact, with its major components of below

- Having mild symptoms now approximating 7,000? should increase to 10,000 by 2005.

- Compressor stage pressure ratio was pegged at 1.3 for both subsonic and transonic compressor designs should it prove essential to 1.4 for transonic compressor stages.

- Heat release in the combustor should be checked by 1972, looking for shorter and higher coefficients than now.

- Thrust-weight ratios now ranging between 5 and 10 should increase to 14 by the end of the decade

These experiments were conducted in an engine in the 7,000-hr fleet category, which represents a medium-sized engine, now. Collier emphasized that there is current GE interest in the life fan technology now being installed in the Raytheon VZ-11A test aircraft (VW Aug 30 p. 37), and in a design of that system which GE calls a cross-flow.

Essentially, this is a blower in a vertical plane producing thrust instead of lift. Studies of thrust) made by CE indicate that the cruise fan water could be used to power a shaft-hub transport weighing 14,000 lb at a designpoint speed of 400 ft and an altitude of 70,000 ft. Such a design could have specific fuel requirements much lower than takeoff values. Typical specific values: 0.27 lb./lb./hr. climb



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The Honeywell ESG was originally developed with funding by the Navy Special Projects Office and Wright Air Development Division. Further developments, including the MEG (Miniature Electrostatic Gyro), are being made with the technical support and funding of the USAF Aeronautical Systems Division, as well as company sponsorship. The MEG demonstrates Honeywell's advanced technology in the field of inertial systems and sensors.

The ESG and MEG are based upon Honeywell's experience in developing and producing more than 35,000 inertial gyros and accelerometers. These inertial devices have been used on 62 of America's successful orbital shots and on such missile programs as Sergeant and Polaris.

For further information on Honeywell's inertial sensor capabilities, from research through manufacturing, write Dept. AW-14-66, Minneapolis-Honeywell, Minneapolis 40, Minnesota.

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Aerospace Orders—First Quarter 1962

Values of backlog of orders, net new orders, and net orders reported by manufacturers of aerospace aircraft, space vehicles, missiles, and related parts: First quarter 1962

(Millions of dollars)

Type of product or service	Backlog Mar. 31 1962*	First quarter 1962		Backlog Mar. 31 1962	
		Net new orders†			
		Prices received	Sub- contract or fillings		
TOTAL	18,568	8,846	101	3,479	18,568
United States government	9,042	3,332	xxx	3,037	18,558
Other customers‡	9,526	554	128	438	2,721
Complete aircraft and parts, total	5,444	442	46	1,119	5,264
United States government	2,568	454	xxx	768	2,728
Other customers	5,476	344	46	379	1,494
Aircraft engines and parts, total	1,384	234	4	282	1,264
United States government	1,084	197	xxx	197	1,104
Other customers	480	72	4	115	480
Missile and space vehicle systems, engines, propellers, units and parts, total	5,821	1,347	13	1,412	5,748
Missile and space vehicle systems and parts	2,844	617	16	594	2,870
Missile engines	360	567	1	515	360
Space vehicle systems, United States government	1,000	100	xxx	100	1,000
Space vehicle systems, United States government	567	100	10	305	462
Space vehicle systems and their engines and/or propellers, United States government	338	200	10	37	369
Other aircraft, space vehicle and related engines, total*	1,003	361	129	414	3,422
United States government	1,402	211	100	422	5,402
Other customers	200	20	129	182	710
All other products and services, total*	1,140	184	44	395	1,140
United States government	192	221	xxx	201	992
Other customers	188	48	44	14	148

* Rev. est.

† New orders received during the quarter less cancellations during the quarter.

‡ Includes some reported values, primarily those associated with subcontracts, the so-called "night and space vehicle systems, engines, propellers, units and parts" items, though such values were reported as United States government orders.

§ Includes all non-aerospace manufacturers who submitted other aerospace products (including aircraft and engines) and related orders and receipts for applied research and development on items such as design, etc. Receipts for other applied research are included with figures for the respective reporting companies.

¶ Includes all non-aerospace aerospace units and non-aerospace products and services and all basic research.



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AVCO/RAD is presently searching with AVCO, Inc., Ames, Massachusetts, for sales and other qualified people.

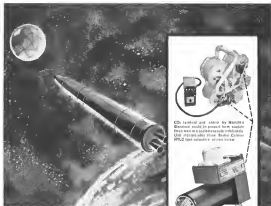
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MISSILE ENGINEERING

USAF Planning Advanced ICBM Studies

By Barry Miller

Los Angeles—Comprehensive review of ballistic missile concepts which might make new types of ICBMs available for deployment in the 1965-74 period—or at least not meet present strategic missile thinking—will begin with next week's a USAF Ballistic Systems Division conference-dinner study effort (AW Oct. 15, p. 28).

Approximately 300 industry representatives from about 55 aerospace companies attended hearings at Norton AFB, Calif., recently to hear Air Force representatives outline requirements for what is believed to be a maximum of 15 limited studies and advanced development contracts embracing 30 tasks.

Industry proposals for these fuel-pulse contracts are due on a staggered schedule starting last but not least. Aerospace companies attending the hearings included: Aerojet, Aerojet, Boeing, Douglas, General Dynamics, Autonetics, General Electric, General Motors, Hughes, International Business Machines, International Telephone & Telegraph, Ling-Tec Company, Lockheed, Magnavox, McDonnell, Minneapolis-Ingersoll, Northrop, Radio Corp. of America, Raytheon and Sperry Rand.

Essentially, the studies and development efforts cover several missile concepts and various associated technical areas applicable to one or more of these studies. These efforts are widely interpreted in industry as another Air Force attempt to explore and review the entire field of long-range ballistic missile technology, possibly applicable to its future, earth-to-space weapon role.

Some of the ideas appear to be a review of what has already been conceived in many of the funded and unfunded Air Force study requirements of the past several years.

- Among ideas to be explored are:
 - Combined use of the nation's early-warning systems to increase survivability of missile units. The possibilities will be explored of coordinating data on positions of impact points for enemy missiles with launch of U.S. response. This would permit launching of U.S. response launched in the practical space even before hostile missile impact.
 - Modified usability. Attention is also being given to the cost-effectiveness of units increasing the number of hard-core ICBM sites and prepositioned shift

ing the missile component among a large number of sites, thus having a wide area always available. This would boost a potential enemy's cost of attacking in a large number of hardened sites.

- Dismantle missile analysis. Stemming from industry is basic efforts of General Dynamics-Altkor in its "Other" concept (AW July 8, p. 16, Oct. 15, p. 26), the dismantled concept involving a missile, protected in some type of container, left undisturbed at various sites, such as in water or Arctic wastes, and standing by for rapid activation on command. The missile could be disassembled—possibly in some type of cover which, on signal, would change the missile's guidance and control components. Within a 15-min. alert period,

it might respond in proper targeting capacities. These studies would have to be extremely flexible over long life-span and subject to expansion, or no maintenance. Air Force is cautioned to feel that even a dismantled missile deposited in the same base for long periods would be representing a low hostile environment that a missile weapon is upon.

- Global mapping. Under this task, an essentially long-range ballistic missile, possible able to reach the earth's surface or completely and thus any spot in the world, even by traveling a long way around the globe, would be studied. Some thought can be given to a vehicle circling more than once, a showback to the other positive control base hard-ware system, a scorable ICBM (AW



Nuclear Stage Shown on GAM-83B Bullpup

First photo of Minuteman ICBM nuclear stage mounted on GAM-83B Bullpup (AW May 2, p. 16) shows slightly hinged second stage carrying nuclear warhead. Third stage contains warhead detection system controlled by Air Force. Made a standard wings wing of North American T-100 jet fighter. GAM-83B possesses off-boost guidance system which enables pilot to control the missile from point of launch, thus increasing distance between the launch aircraft and point of nuclear detonation.

THE BARTY OF QUALITY





Standard Space Launch System Shown

Airline's concept of Air Force 6248, Standard Space Launch System planned for Cape Canaveral (AW May 21, p. 96) shows four main service docks in three launch pads. Designed for use with Titan 3 space boosters, system permits for inspection, storage and mating of solid motors with liquid boosters.

Dec. 5, 1966, p. 16), envisaged by military under Air Force study requires more in the 1990s. The global-range missiles would be launched as early as possible after an attack. Thus, they would be on their way toward targets pending verification of an enemy

attack. Should attack warning prove false, the vehicles would be dropped back into the sea.

• **Maneuverable reentry vehicle.** How much attention will be focused in these studies on maneuverable reentry vehicles as distinct from the global rang-

ing concept a jet effect, particularly because the B5D reentry vehicles directorate is expected to have a later, separate study on this subject. B5D reportedly is actively seeking new ideas in this area. Several companies, including McDonnell and General Electric, have proposed maneuverable reentry vehicle concepts. Air Force might prefer a vehicle which could maneuver after reentry to force an enemy to commit his defenses to a given cone of defense before the vehicle switches to a side course. GE has presented a reentry vehicle system called Lapidus which employs tandem jets that can operate through extremely high acceleration levels of reentry.

Specific focus in the ballistic missile studies are divided among three separate proposed requests. In one, "Study of Advanced Packaging Concepts for Ballistic Missiles," RFP 64-(094)-51-117, there are expected to be 14 studies in six task categories, as follows:

- **Packaging.** This is to cover conceptualization of the descent course. Proposals are due Nov. 3; two contractors can be selected by Feb. 1 for 10-month studies. Contractors are expected to be \$275,000.
- **Large payloads.** Planned \$100,000 studies will be concerned with exceptionally large payloads for knocking out enemy hardened ballistic missile sites.

Proposed deadline is Nov. 3, with the contractor selection scheduled by Feb. 1. These studies will both be for 14-month durations.

- **Early warning.** A pair of dual \$100,000 six-month studies to explore the use of early warning systems to acquire maneuverability will be awarded on Mar. 3 on the basis of evaluation of proposals to be submitted on Nov. 19.
- **Hardened mobility.** Possibly only a single \$100,000 study of 11 months' duration will be awarded at the first of the year after evaluation of proposals due for submission Nov. 19.
- **Global coverage.** Dual eight-month contracts for global ranging studies, including command and control components, will be awarded Apr. 1. Proposals are due Dec. 3. Contractor value will be about \$300,000.
- **Extended deployment.** Three 10-month contracts scheduled for award Apr. 1 will explore missile deployment. Proposals are to be submitted by Dec. 19.

Potential contractors are being asked to submit proposals for both a single \$2 million, or theoretical \$3 million, advanced development contract covering command and control systems for descent, launchable missiles. Due \$2 million or two low-concept contracts \$1 million contracts will be awarded. Proposals



Coal-Tar Coating Protects Missile Complex

Guinea coatings 70 B coated and Ebanoxite No. 93, produced by Koppers Co., Inc., protect a \$9,000 gal tank and associated cable ducts and walkways which will be buried 10 ft underground at a California missile base. Tank also will be wrapped in tar-saturated felt. Tanks which will contain potable water are coated inside and out with the 70 B enamel which requires no primer to adhere.



THE FLIGHT OF THE HUMMINGBIRD

This is the new XV-4A (formerly the VZ-10) Hummingbird now being developed for the U.S. Army Materiel Command by Lockheed-Georgia. It has been flying since July 7, and is progressing successfully in its flight-test program.

The Hummingbird, as the name suggests, will take off straight up, land straight down, hover, then dart away at speeds up to 500 mph. It combines — with simplicity — the characteristics of a helicopter and a high-speed jet. Mission: to work

In the air for the Army a year from go-ahead

directly with the troops in performing surveillance and other missions.

The principle of the Hummingbird is a system of jet-powered chambers in the fuselage, fed by high-velocity exhaust from twin jet engines. In

vertical flight, gases are directed downward through bomb-bay-type doors. In conventional flight, these doors are closed and forward thrust is provided in the normal manner.

LOCKHEED-GEORGIA COMPANY

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there's a ship on the way to the moon

There will be easy access then, but every shot on the Apollo-Moon target path the U.S. closer to its goal of a lunar landing in this decade.

Seen our capabilities on the range will be sharply increased in Advanced Range Instrumentation Ships (ARIS)—large transports converted to carrying large antennas under direction of the Space System Management Group—go into service. The highly accurate sensor, support and recovery data the ships collect will greatly advance the system support capability of ARIS.

Sponsored by the Air Force Missile

Test Center, AFSC, the ARIS ships will incorporate every advanced technique of data acquisition and handling, including instrumentation to radar, telemetry, orbital navigation, weather forecasting. With mobility and precision they will move to any viewpoint in thousands of miles of ocean and take measurements with all the precision of a land-based station. They will provide refined study of space vehicles during the critical terminal phase of flight. Sperry's job is to design the land instrumentation available and integrate it into the job—on schedule and at minimum cost.

The ARIS ships will help guide ARIS responsibility with NASA for major instrumentation supporting our exploration of space. The capabilities developed will be widely advanced in pace with the program. Team members with Sperry include Bethlehem Shipbuilding, Ford Instrument, Gibbs and Cox, ITAT and UNIVAC Division of Sperry Rand.

SPERRY



ARIS SYSTEM MANAGEMENT GROUP, SPERRY GYROSCOPE CO., DIVISION OF SPERRY RAND CORP., GREAT NECK, N. Y.

for 15 month contracts, to be completed May 31, 1965, see also Jan. 1.

Heavy emphasis will be placed on a mobile command center for domestic missiles, with the likelihood that command will be exercised from airborne platforms or the ground.

Need for reliable missile automation and the related question of how to transfer information to a missile under water will be researched closely. Space-based command center is only a remote possibility. Command and control centers will be based in response to RFP 04-4940-G1312.

There will be three advanced technology development efforts in the guidance field. As in the command and control area, contractors will be expected to identify areas requiring development and carry out development of these companies throughout industry so that immediate implementation can follow, if necessary.

Desire to reduce the carrier error probability (CEP) for any weapon is forcing the Air Force to concentrate on radio guidance techniques. It is hoped that this latter method may provide greater accuracy, although it is subject to jamming.

Three specific guidance efforts will be:

- Sustainable radio guidance. This seven-month contract will explore ways of lowering the CEP, ensuring satisfactory capability and integrating control. Deadline for proposal is Nov. 30, with awards due Dec. 1.

- Surveillance guidance contract or contracts for the ground-based antenna to be awarded Jan. 2 and are expected to expand through September, 1964. One problem will be how a floating, distant antenna, subject to continuous changing position, can establish its initial coordinates prior to firing. Proposals are due Dec. 10.

- Radio command for the global range. This will be an eight-month effort scheduled to start Dec. 1.

There is a feeling in industry that these competitions will have no greater impact than had earlier Air Force studies conducted in the study representative of the past.

This may be particularly true now, with Defense Dept. closely scrutinizing Air Force weapons system development proposals.

At the briefing Air Force is reported to have stated that stress would be placed on the grounds of cost-effectiveness. Nevertheless, there are indications that industry participation in the development of these studies and advanced development contracts will be widespread.

Accutec Corp. is supplying Air Force with technical guidance on these efforts.




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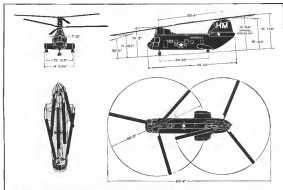
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Marine CH-46A Designed for Ship, Field Operation



These views showing short ground layout of CH-46A, namely, Integrated HRS-1. Side view shows second forward flight attitude. Note roll-on motion side of Main Deck above motor for lower lift to permit CH-46A to fit on elevator of LPH-2 or LPH-4 inside ship.



Erp ramp can be extended as high as all yards (above, left). Loading ramp, hydraulically actuated, is fitted with both rollers for cargo pallets and tracks for wheeled vehicles (above, right).



Blade folding system has actuator and electric motor (right) fixed in hinge near the noise hump. Hinge and actuator kept on outside so blade to the right of the pylus is photo (below, right). Motor runs out when blade has stop at the end of its folding travel, closing out need for cut-off switch.



Accessibility of systems to low and all rates systems is shown in ground demonstration (below). Engine access is from below, and the ramp can be used as an adjustable height work platform for support. Inside configuration differs from the Virid 310 because of addition of a portable separation system (AW Oct. 12, p. 30).



EQUIPMENT

Mass Production Process Shown For Superalloy Gas Turbine Parts

By Donald E. Fink

Minerva, Ohio—Facility capable of mass-producing high-performance gas turbine components in the vacuum-melting process was demonstrated here recently by Kaiser Industries, a division of Thompson-Rumney Workholding, Inc.

Compass officials said the facility will make sophisticated components economically feasible through mass production, thereby enabling gas turbine engine manufacturers to receive greater performance from existing engine designs.

Gas turbine efficiency, dependent to a great degree on the inlet temperature, has not been fully exploited; they are, because engine alloys capable of withstanding the higher temperatures previously have been manufactured only in mills up to 50 lb. and have therefore been very expensive.

Nelson G. Speth, Kaiser's general manager, said the company's new wet-scan-cooling and casting furnace has run 130 lb. m/t in semi-continuous operation and is capable of handling 500 lb. loads.

"With the semi-continuous furnace, various-sized components can be made in a quarter of the time previously needed," Spotts said. "And by raising furnace capacity from the average 50-lb pour to 150 lb., much larger castings can be turned out."

Spills and the power zones, critical areas where high temperature and quality of metals govern the entire power output, represent about one-third of the complete turbine assembly cost.

"Of this one-third 50% is represented by the extra-metal backing, blades and vane. This amounts to only 17% of the turbine cost, but it is the 17% in which performance improvements are unscientifically possible."



COMPONENT CASTINGS up to 150 lb and 48-in.-dia. can be developed in pour chamber at Eductech Industries.

In some cases, company officials estimated that capacity of some extrusion systems could be increased by 200 hp with a 25% increase in motor power. Superalloys required to withstand the temperature stresses, however, are extremely sensitive to impurities and must be worked under vacuum, so metal impurities and oxides will



PERHEAT CHAMBER at Robert Industries, left, will accommodate 68 units at capacity. New facility, right, integrates three process steps: preheat (a), pouring (b) and cooling (c) into continuous-line operation for mass production of turbine components.

escape in gaseous form. Vacuum work
ing also makes possible a closer control
of furnace and atmospheric impurities
around the metals.

As a result of the special handling required, the cost of superalloy turbine components has increased about 300% higher than the cost of as-cast, zinc-coated components used in lower performance engines.

In certain aspect and lightweight aircraft applications, performance requirements relegate cost to a secondary level, but for the majority of general aviation engine users, selection has to be based on the ratio of dollars per horsepower delivered, Smith said.

Kolczak undertook a research program five years ago aimed at taking the problem of high cost of supervisory care.



parents. The result, after an investment of about \$2 million in company funds, is the 100-500-lb semi-conductive vacuum furnace.

Voltage production with the facility will bring about substantial decreases in the cost of superalloy components, Reed said.

The facility, which occupies about 750 sq. ft. of floor space, consists of

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There is an intensive program for the development of Deussen and related projects (digital computer controlled systems, automatic workcell analyzers, peak reading voltmeters) being carried forward at Curtiss Wright Electronics Division. These and other advanced activities have created immediate opportunities for systems engineers and circuit designers with specific experience on automatic checkout equipment.

For complete information, please write Mr. Sam P. Kelly, Manager of Professional Placement, Electronics Division. An Equal Opportunity Employer.

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three major systems: preheat chamber, pouring chamber and cooling chamber.

After ingot quality has been tested to temperatures of 1,700°F to 1,900°F in a series of preheat zones. The ingots are then cooled and placed in the facility's 40-ft. preheat chamber. As the molds move on a chain conveyor to the pouring chamber, electric heat elements maintain the temperature at about 1,110°F. Chamber capacity is 60 molds.

When the preheat chamber is filled, it is sealed and evacuated. The vacuum lock between the pour and preheat chamber is opened and the metal composition and crucible temperature are checked by remote control. The composition molds are then poured and moved into the cooling chamber by another conveyor. Once the preheat chamber is emptied, vacuum locks are again closed, and the cycle is repeated.

Production rate requires a maximum of 4 hr. Operating on a continuous three-shift basis, the facility has an annual capacity of 150,000 to 200,000 lb of superalloy. Another advantage of the large work facility is its ability to handle castings weighing up to 150 lb and measuring up to 45 in. in diameter. Less turning time is required, since margins are taken from each larger effort, on which the quality control can be constant.



XB-70 Environmental Control System Checked

Redesigners package the North American XB-70 and electronic equipment environmental control system undergoes final checkout by Hamilton Standard technicians before delivery. System will power "blowdown" environment for crew when skin temperatures reach over 45°F. It controls humidity, air pressure and ventilation for cabin and also tests compartments, as well as temperature.

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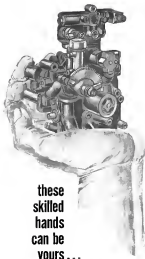
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Ablative Plastics Used For Rocket Cooling

Liquid rocket engines for space-stage use, incorporating ablative plastics for cooling, has been designed by United Technology Corp.

Engage's thrust chamber liners are reinforced from plastic legs formed by pressing small squares of reinforced glass cloth together under pressure. Abrasive abrasive is placed around base, and the outer structural shell is composed of glass fiber.

When the engine is fired, heat from its combustion gases is absorbed by the chamber's ablative base and its exposed inside walls and vapors to provide cooling.

Engine is approximately 45 in. in diameter and about 150 in. long, including ablative chamber. A variable thrust injector can vary rate of propellant flow.



Titan 3 Fluid Pod

Model displayed recently to President Kennedy (NY Sept. 24, p. 12) of USAF Titan 3 boost vehicle shows post-mail cylinder between right-hand solid boosters and Titan 2 core—being evaluated to meet fluid for boost vehicle control system.



SOLID PROPELLANT rocket motor originally developed as a booster for the USAF Minuteman was stored for five years before recent successful static firing.

Solid Motors Fire After Long Storage

Three Thielert M16 solid propellant rocket motors have been successfully static fired after protracted storage periods. One of the motors had been in continuous storage for five years, the other two for 35 months.

During this storage period no special treatment or precautions were taken to preserve the rocket motors which were originally developed by Thielert as the booster unit for the Air Force TM-61B Stentor, which is currently designed Minuteman.

The motors were stored in a reinforced concrete silo with no thermal stress or humidity control. Relative hu-

midity reached as high as 94%. Inside temperature ranged from a high of 88°F to a low of 70°F.

Five-year-old M16 motor was tested by personnel of the U. S. Army Missile Command at Redstone Arsenal. The motor was temperature conditioned to 77°F for slightly over an hour before it was fired. There was an elapsed time of 1 hr. 16 min. between removal of the motor from the combustion chamber to the actual static firing.

According to Thielert the three motors tested "performed within the tolerance limits established for new motors."

Acceptance of the M16 began at Thielert's Huntsville facility in 1955 after the motor was developed.



M16 is shown after static firing. Motor performed within the parameters established for new units, according to Thielert. Successful test was conducted at Redstone Arsenal.



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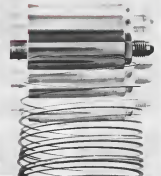
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For over 800 miles, this miniature low pressure potentiometer type transducer was subjected to a 7000 (RMS) pounds of random Gaussian vibration all three during the test (the error was less than 0.5% of full range). This superior performance was the result of several new design techniques. Vibration modes of the individual components were carefully studied with particular care given to the resonant conditions. First, the potentiometer wire arm was modified to raise its natural frequency well above 2000 cps. It was also carefully counter-balanced for resonance deflection at 1000's steady state acceleration. Next, a set of Sereno's patented backing capsules replaced the conventional single capsule design. This provides a constant "loaded" condition as the pressure sensing elements resulting in less vibration sensitivity. Thirdly, the entire moving mass of the driving frame was reduced by almost 50%. The effect of this reduction in mass is an increase in the natural frequency of the moving mass. Finally, the design was made extremely rugged. And, last, the case was fluid filled to damp-out spurious vibration effects. (The Model 3061 is available for absolute or gauge pressure measurement in ranges from 0-15 to 0-350 psi with an operating temperature range from -65 to +125°F./Min. for further details on the Model 3061).

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Business Flying

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Rolling around 300 five-place Mustangs including 78 sport utility, current is being worked on by Birch Aircraft Corp.

Approximately 11,500 business and utility aircraft stopped at Southeast American Co. at Love Field in Dallas during the first six months of 1962 and were refueled with approximately 2,091,800 gal of aviation fuel, setting new company records in servicing airplanes. Airlines represented 54 states and five foreign countries. Southeast American estimated that the total value of the airplanes it served in this period was more than \$300 million.

Cessna Aircraft Co. has reported total sales of \$57,700,000 for Fiscal 1982, which ended Sept. 30. This represented an increase of approximately \$7,100,000 over Fiscal 1981. Preliminary operating income after tax earnings were \$1.40 per share, compared with \$1.28 per share for Fiscal 1981. Largest increase came from commercial aircraft sales, which totaled approximately \$33,500,000, a 17% increase over 1981. Military sales declined from \$21,091,000 to \$21,979,000. Despite \$9.5 million in R&D, Cessna president and chief executive officer, Richard D. Smith, says the company was closed by production and engineering costs in the new Model 441 and revenues of Models 440 and 410. Company announced a stipend award of \$15.2 million.

Electro-thermal de-icing system for light towers aircraft has been awarded by Goodrich Tire and Rubber Co.'s Aviation Products Division. System, awarded on the North Queen Air 61 and on propeller systems of the Aero Commander 560P, 680P and 690P, consists of a limited wire de-icing circuit to remove snow or ice located on light surfaces and will withstand heavy vibration.

British single-engine antipilot has received FAA approval of installation on four 1962 model aircraft, the manufacturer says. New approvals cover the Cessna 210B, Piper Comanche 150 and 150 and the Mooney Mark 21.

Allied Dunell of London, Inc., New York, men's gift shop, has listed Aero Commander aircraft in its current Christmas catalog. Store officials say they hope to persuade corporate clients to get the two-engine aircraft by executives who need a good deal. Price is listed as "from \$17,800."

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Beech Aerospace Division

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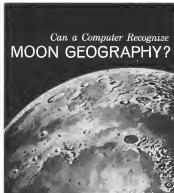
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FINANCIAL

L-T-V Securities Form Holding Company Basis

Dallas, Tex.-Alpha Omega Corp., a new holding company equally owned by Long-Term-Vought based vice chairman and executive committee chairman James F. Long and Dallas businessman D. Harold Smith has been formed to provide a base for further expansion of business interests by the partners. Long-Term-Vought securities will be the principal asset of the new company.

Smith, chairman of the board of Alpha Omega, and Long, president and chief executive officer, declined to elaborate on the holding company's future plans until Securities and Exchange Commission completes its study of the new organization.

Long, who had been disposing of a large quantity of his Long-Term-Vought holdings in recent months, stated he still maintained effective control of the company through holdings by his Long Investment Co. and ownership of shares and debentures by partnership interests. Long had disposed of more than 22,000 shares of the firm's common stock, reducing his personal holdings of common to 11 shares, plus 14,800 common shares held by Long Investment, leaving it with some 15,000 shares, in addition to its diverse interest of considerable warrants and debentures.

Contract Formalized For 35 Atlas Vehicles

Washington-Air Force has formalized the contract to General Dynamics/Aeromarine to supply 35 modified Ad-1 space launch vehicles, to be called XV-1, which will contain standard guidance, electrical outcues, autopilot tracking and telemetry kits (NAV Oct 8, p. 41).

SLV-1 engines will be rated at 300,000 lb thrust. Mainstage and launch site will dictate which of the interchangeable components will be used. General Electric Model 30 guidance unit will be supplied for Asterix-Merle Range launches, and the GE Mark 2 will be used for Pacific Missile Range flights.

Each booster will be identified as to mission and launch site eight months prior to delivery date.

Incremental funding to date on the contract is \$3 million, with total launch cost expected to amount to approximately \$70 million.

SLV-1 with Agassiz B upper stage will be able to orbit loads up to 6,000 lb in altitude under 3,000 mi.



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Financial Briefs

National Aeronautical Corp. and subsidiaries raised \$694,194 on sales of over \$2.5 million for the nine months ended Aug. 31. The figures were 175% over \$195 increases, respectively, over earnings and sales for the comparable period last year.

Avco-Corrad Corp. had consolidated sales of nearly \$41.6 million with earnings of over \$5.6 million for the nine months ended Aug. 31. The figures were 261% and 20% increases, respectively, above sales and earnings for the same period last year.

Dynasore Corp. of America has raised its listing from the American Stock Exchange to the New York Stock Exchange. The firm is listing 4,116,550 shares of common stock, of which 5,000,000 are outstanding, in addition to 447,183 shares of convertible preferred stock which were previously traded over the counter.

Dallas Aircraft, Inc., reports \$5.45 million gross revenues—\$5 million of which was derived from commercial sales—and \$182,759 net income for the six months ended Aug. 31. Same period last year showed sales of \$5.1 million with earnings of \$185,308.

General Electric had net earnings of nearly \$279.5 million on sales of nearly \$4.5 billion for the first nine months.



Apollo Radiation Pattern

Apollo experiment antenna antenna pattern is shown radiating measurement by Col. Ben B. King, using a radio model at the Cape Canaveral's Duffin facility. At the apex of the experiment is a descriptive antenna which Collier is evaluating for possible use.

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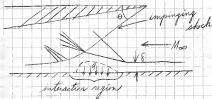
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of 1962. The figures were 19% and 11% increases, respectively, over the same period last year. All four major segments of GEI's business—military, aerospace, and defense—experienced in the overall sales and earnings.

Continental Aviation and Engineering Corp., of Detroit, had more than \$12.6 million in sales with net earnings of \$170,015 for the nine months ended July 31. However, \$1.6 million in sales for the three months ended July 31 was accompanied by a net loss which totaled \$1,918.

Spadon Associates, Inc., of Noida, N. H., reported nearly \$42 million in sales and other income for the fiscal year ended July 31. Spadon net the figure would be a 95% increase over last year's sales and income. Net earnings are expected to total about \$3 million. Spadon also predicts that fiscal 1963 sales will total more than \$40 million.

Mergers and Acquisitions

Happ Corp. of Cleveland, has sold 80% of its capital stock to a group of three Genco, Inc., officers. Genco is a Happ subsidiary now making profitable profits and both sides for Republic (Fiji) and other aerospace components. The three Genco officers have until 1967 to buy the remaining 20% of the Happ Corp. stock.

Soliman, Inc., of Anaheim, Calif., has been recently acquired by Electro-Mechanical Research, Inc., of Sonoma, Fla. Soliman was a U.S. subsidiary of a Soliman, Ltd., of England, and is a manufacturer of transfer function only and is laboratory and field electronic test systems.

California Aerospace Corp., of North Hollywood, has purchased Aerotech and Merit Corp. of Los Angeles, for about \$2 million. The purchase includes 1,600 Wright and Pratt & Whitney engines, variety of mass, aerodynamic and propeller parts, tools and the means other equipment.


Computer Instrumentation Corp., a Philadelphia computer test equipment manufacturer, has been acquired by General Electric, Inc., of Atlanta, Ga. GEI acquired Computer Instrumentation by exchanging common voting stock for all the outstanding shares of the corporation. GEI manufactures a line of specialized production and preventive maintenance equipment for magnetic tapes.



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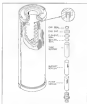
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Filter cartridge that can be completely taken apart and cleaned is designed for filtration of fluid in aerosol, hydraulic systems, and liquid oxygen and hydrogen fuels in rockets, the manufacturer says.



The logger, Model 24271, pairs the temperature measurements on paper and displays them on a four-digit read-out from +00.04 to ± 75.00 millidegrees, covering the useful range of chemical stored thermocouples up to 2,500°F. Station speed is about two seconds per thermocouple. Absolute accuracy is ± 0.25 millidegrees and stable sensitivity is ± 10 microvolts.

The data logger is contained in two modules: one contains thermocouples, solenoid, pressure transducer, scanner switch and differential preamplifier; the other module contains control, sequencing and recording component. These can be located as much as 100 ft apart. Use includes piston and turbine engine design, heat transfer studies and guided missile and aircraft testing, according to the manufacturer.

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Lightweight Life Jacket

Life jacket designed for use on civil aircraft except 4 in 5 on less than some smaller water, the manufacturer says.



Jetset has self-righting features and is designed to allow swimmers waves to maintain the best rotation angle for speed.

The pocket, Model (LA), weighs 20 oz. and can take lifting operators 50 to 60 lb. of payload on an incline over water. Split carving 110 psi supports the manufacturer says.

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Sales Dept., Jay-Bil Products, Inc.,
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Armstrong, manufactured by Vesta, Ltd., of Sydney, has fast open airflow and flap, spring-type landing gear, bubble canopy and a single-engine, tapered-chord wing. Right flap is under fuselage. Cockpit is built with plastic and instrument panel moves forward under fly stick.



Airframe is powered by 100 hp Continental Q 200A as a 115 hp Lycoming Q 235. Useful load is 615 lb and gross weight is 1,810 lb. Wing span is 26 ft, length is 20 ft, 9 in. and height is 6 ft, 10 in. Airframe cruises at 135 mph and has a top speed of 151 mph. Aircraft is fully aerobically. Service ceiling is 15,000 ft and aircraft has a range of 840 mi.

of aircraft controlled during those approaches had been U.S. military as well as U.S. civil aircraft. The radio malfunction of Sherson is unique in that it is the only probable cause and reported failure of its kind among U.S. civil air aircraft. The radio operator could not be contacted by TAA, nor could he demonstrate his control and competence to perform his assigned tactical functions nor to be required to undergo recurrent training with us in accordance with TAA controlling personnel. At Sherson the installation of electronic equipment could not be approved by appropriate and timely means by the TAA.

Flight Crew

The flight crew consisted of Captain Edward E. Bowman, alternate Captain Gilbert W. Sargent, Captain John F. Reid, Jr., Flight Engineer William Demore, Flight Engineer Dwight Kellock and Navigator Edwin A. Mykrom. The crew was to alternate its duties in order that no one would become fatigued at his duty station and, as well as could be determined, this system was met. Captain Bowman, Captain Reid, and Flight Engineer Demore had flown N 6619C into Sherson Airport, landing at 1912 on July 12, 1961, and again at 1024 on July 14, 1961. Both landings were accomplished when ground crew hailed approaches in Instrument Flight Rules (IFR) weather conditions.

From its origin at Fort Worth, Texas, on July 23, 1961, the flight program had been continuous. The flight crew from Fort Worth to Travis AFB was 2 hr 36 min. The flight was on the ground at Travis AFB for 1 hr 17 min. The flight crew from Travis AFB to Vandenberg was 3 hr 19 min. The flight was on the ground at Vandenberg 1 hr 18 min. The flight crew from Vandenberg to the time of impact was 6 hr 10 min.

Tediousness of Alaska Airlines flight operations supervisory personnel and examination of the crew's training records indicated that all qualifications and proficiency requirements had been met except for the qualification into Sherson Airport by Captain Bowman.

Analysis

Flight CCA 770 is considered to have been planned in accordance with existing company procedures and applicable regulations. At Travis AFB the cargo was loaded in a manner which did not adversely affect the safety of the flight's operation. There is no evidence that the cargo had shifted prior to impact. The aircraft had been modified for hauling cargo in accordance with approved specifications.

The aircraft had been serviced with the proper type of fuel, and it is believed that the AIC and antiwhirling systems were capable of normal operation.

Examination of the postmortem revealed that all four engines were capable of producing adequate power, judging from the examination of air pressure assemblies, the power being developed by the engines was felt by technicians and to provide satisfactory CG's at all loadings under the existing weather conditions. The engine applicable to the engine for a CG's approach at Sherson was using 450 lb and velocity 1.3. The weather



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CERAMIC ENGINEER—BS or MS in Ceramic Engineering plus 3 years experience in aerospace industry or related fields to perform work in refractory materials research and development which includes ceramic materials, polymer composites, and electrophoretic resins.

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OPERATIONS RESEARCH ANALYSTS—Operations Research and Systems Analysis (For Space Systems)—Individuals with desire to be broad conceptual analysts in the field first, research first, and the objective values of capabilities of proposed systems to meet future space needs. Advanced degrees and experience in systems thinking desirable.

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To perform research and development in concepts involving air and space vehicles ground installations involving radar cross section techniques, and reconnaissance data processing.

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involved in the flight in the GCA configuration, according to its testimony, not only 200 ft and velocity 1 mi.

The construction of last aircraft kept the full qualities indicated to the main task group, complete with the full speed given approximately 25 mi per sec in the accident, and the lack of any large safety in fuel lines, doors, and wings, such as to render the full loss to all systems was normal given to subject and not inconsistent with the aircraft's design.

Control surfaces and control mechanism were to form, both in normal operation. There is no evidence that one of the controls was malfunctioned.

Accident Statistics

Examination of the structure of the aircraft showed that they were designed around before impact. The landing gear was done and tested, and the wing was properly and fully reinforced for completion of the full approach and landing. The landing lights were installed and believed to have been as intended as they were observed by the witnesses to have been on. From the landing lights were on it is believed that the aircraft ran before the crash during some portion of the approach. One of the lights on the aircraft would have caused a true reflection to have been experienced by the crew.

Consequently the world has learned that ability to make visual contact with the enemy.

The No. 3 VHF radio approach about its ability was operating normally at last with the crew. The GCA approach around the instrument on 114.1 mi to go, some time in the flight upon beginning the GCA full approach. If during the full approach the light were to have functioned a direct warning to the crew would have been heard in the GCA, however it would probably have been heard in the ground station. This is the first time the light was heard in the ground station. The No. 3 VHF radio was tuned to 121.5 MHz and the instrument transmitter to 121.5 MHz it is assumed that the crew either received it or not.

Alphabet Weather

The weather conditions during the flight of the aircraft were not reported. The crew reported a 200 ft ceiling and 1 mi visibility. The crew reported to have been running low on fuel at 114.1 mi and the beginning of a landing at 200 ft is a possible guess, to the U. S. Weather Bureau under such conditions. The forward visibility of the crew when it was high the approach lights could have been in low or 1 mi at the time the aircraft had been down of clouds in the area. Conditions of the approach in the approach in the approach were not consistent to the aircraft, and it is believed that the aircraft was in a position to land according to the crew and the data. The accident occurred during the last of complete darkness.

It is believed that the aircraft had the reported weather conditions to the extent

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If you'd like more information about these opportunities and others that may be available, write to J. Paul, Engineering Center Personnel Office 1201 East Broadway, Hawthorne, California.

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About General Dynamics / Fort Worth:

Virtually the entire spectrum of engineering and scientific disciplines and fields is encompassed in the Engineering programs, which support the National Space Effort. Present in the technological development of the Southwest, General Dynamics/Fort Worth is concentrating this role in the area of aerospace.

Project activities range from design acquisition and preliminary systems to launch systems, from low speed to hypersonic air-breathing vehicle systems, from orbital systems to space station effects studies. Laboratory and

test equipment supporting the programs include: state-of-the-art electronics, nuclear, and test laboratories, a hyperthermal research facility, an ultra-high-pressure physics laboratory, bank special and general purpose computer facilities.

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GENERAL DYNAMICS | FORT WORTH

LETTERS

Bus Kudos and Boos

We are very much interested in your lead words on the editorial page of your OCT. I was contacting the Miami Lounge at the Dadeland Airport especially your lead words on those bags "taxes" have been so noticeably low.

Your extremely late evaluation of these controversial vehicles is flawless. Simply appreciated both by Chrysler and by Ford!

The Ford Co.
Philadelphia, Pa.

I applied you editorial in the Oct. 1 issue, but take exception to your suggestion that U.S. leaders adopt the European system of universal laws.

This system reduces the flexibility of hearing a large number of passages and naturally runs off any passages whose stress after the last has less than enough time to be in time for the light. I find that any system dependent on a set time of departure has the energy, such as a line, is not the solution, but some transportation system is needed which operates continuously right up to the instant of use.

D. P. Evans
Lansford Center, Miss

[illegible]

Instead of having one terminal, we have now created a second speed and study landing and serving area. In what baggage is now changed twice instead of once, the passenger first and without twice and with no saving of time.

Time and aircraft ground handling costs are the primary expenditures and must be properly accounted.

While erroneous in choosing the passage, help they are forgetting about the airplane! This situation was paid to new aircraft handling concepts, the passages handling problem, would be solved for the most part and without additional legal problems by having two transport axes.

Aircraft landing hasn't changed since 1931 as they are still being towed, first by the tail wheel and now by the nose wheel. Puffed first to start and now by 45,000 lb. maximum traction and still with speed limits of only 1.2 mph. It's remarkable.

The new Jet Age is here and with it has come many new problems in the ground handling of large aircraft. Some of them

Annette Werk welcomes the opinions of its readers on the issues raised in its magazine's column columns. Address letters to the Editor, Annette Werk, 120 W. 43rd St., New York 36, N. Y. Try to keep letters under 150 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

are engine room, odors and that is the terminal area. High fuel consumption, engine vibration and heavier aircraft ground loads and overruns at terminal gates. There are the "real" reasons for the need for new landing concepts, not simply passenger comfort. Anyone who thinks differently is just trading the noise. There are others, all of which under present ground handling methods eliminate as they are only "stopgap" methods.

In the past few years new diseases besetting people have come into being, such as, for example, AIDS (which are the most powerful) myocardial pain and leading crops, vitiligo, leprosy and leishmaniasis but none of these have or will take on an acute headline problem.

The pit requires one several hundred gallons of fuel while on the ground, about \$300,000 a month of fuel a year per plane. On top of that, the expense of run and maintain a day on the ground would total over 1,400 U.S. per plane a year for a fleet composed entirely of the plane could be used of rate factors without using its own power, then a savings of over \$300,000 a year per plane could be realized. (The most word on the cargo, operating time should come from industry, not the cost of operating the more...

As the angle of the head and jawed increases, a good deal of research has gone into the wheel-and-axle design, but they still have drawbacks. These designs can be constructed for looking into spot and areas imposed on the aircraft by the unpermitted forces set up by passing close to one set of wheels. However, wheel skids on land thrust them very much to random looking through much. Also the intense advantage is lost in the percentage of the aircraft's angle being in the ground wheel. For example, a 100,000 lb plane has approximately 17,000 lb on each wheel; then, there's a wheel skid would have to have a separate wheel to each wheel.

With the weight of aircraft going up along with those of the ground-based equipment and their costs, there is nothing but one sound reason to explore, that of aircraft-carrying vehicles. The primary advantages of this concept are: utilization of the aircraft's full weight for lift/drag, faster moving speeds, lower ground loads and no structural stress on the aircraft due to low-thrust take-offs.

Several carrying devices have been made: a trailer (which has to be towed), a large dished vehicle on railroad tracks (which is a fixed installation and has a high initial cost). However, let me see a new self-propelled aircraft-carrying vehicle developed and autonomous for all drawbacks of the present. It also satisfies additional benefits:

soft, from three members above. These are, the use of cutting beams and ramps of all major aspects, unqualified marine visibility and maximum utilization of horizontal space due to correct docking, etc. (see, for more extensive treatment,

This highly experienced insurance broker is able to inspect the severity of the problems. A quote from a Douglas Aircraft Co. booklet states: "Estimated repairs to an aircraft damaged by collision with wildlife equipment has not even reached \$1,000,000 annually. Another operator has over \$100,000 a year damage to some extent from having United Air Lines hit 20 Cattle, on the April of this year, one half of them had never been caught damage from ground equipment. And the list goes on."

Let's deal with all our money problems
 first, then add the kids
 Roy P. Cramer

Jeff P. Casanova
 Quality Engineer
 Maaco Co.
 Chicago, Arkansas Division

Huskie Engine

Your article in the Oct. 5 issue of *Aerospace Week* (p. 102) on Korean Aircraft Corp.'s *Hydra* 1 was a comprehensive description of the only U. S. medium class twin tailless helicopter.

It is important to know that one major reason for the Boeing T-40 engine's lack of power is the new aircraft is classified. The article states that the T-60 "has a power/weight ratio that compares favorably with turbojet engines." That is most definitely true because the T-60 is an aircraft engine, not a stationary engine as you mention. The T-60's 340 weight

The T60 stands out for its light competitiveness in the turboshaft engine field.

The T60 stands out for a Navy J600 contract to a helicopter propulsion. The greatest focus of the development of this engine was created out with company funds based directly at the helicopter engine company.

The T60 is a 500 hp, turboshaft engine weighing 150 lb. with a 0.51 specific fuel consumption and a power-to-weight ratio of 3.33 hp/lb.

I would also like to point out that one of the major features of the T60 is a line of weight/size components to give the engine a very low and uniform weight, less than 150 lb. and less than 150 in. long.

The T60 does not have a multi-stage

premier is implied in the article. The newspaper states a double-blind, single-stage comparison with a patient ratio of 0.2:1. This is undoubtedly the highest performance for any repeating single-stage comparison.

A. F. Stuart
Public Relations Representative
The Boeing Co.
Industrial Products Division
Seattle, Wash.

[Boeing's website lists only the 777-300ER as the only aircraft in its long-range jet category for Europe and includes the 747-400.]

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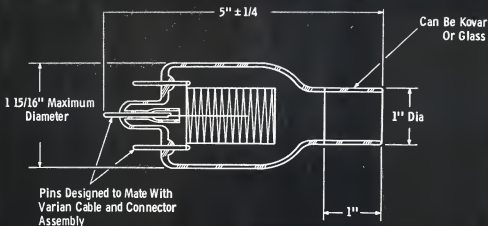
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